

Epoxy will not stick to a smooth surface, it needs something rough to grip onto. Preparing the surface of the concrete by acid washing or grinding gives the coating something to grip onto. Floor coatings are essentially heavy duty glues with color added to them and it is important to give the glues a rough surface to grip onto so that they don't slip. When you go mountain climbing you need big rocks to grip onto if you don't want to fall. Gripping onto a little piece of sand sticking out of the side of the mountain isn't going to do the trick, first of all a little piece of sand is too small to grip onto and secondly even if you were able to get a hold of it the sand wouldn't hold your weight because the sand isn't held into place very well since the mountain doesn't have much sand to hold onto either. Therefore it is important that your concrete surface is rough and also solid and sound so that it doesn't break away from itself.

If you want to build something that you don't want to blow or wash away when the wind and rain of life comes by then you need to first anchor it to a rock. Jesus actually said the same thing in one of His parables, it goes this "A wise builder digs deep until he gets to solid rock before he builds a house on it." Fortunately for us concrete is made of rocks; that's actually what concrete is, a bunch of rocks glued together.

In order to make concrete you mix rocks, sand and water with an adhesive known as cement. The cement is the binder that keeps the rocks and sand stuck together. The concrete is what you get after you add the rocks, sand and water to the cement. After the wet concrete is placed on the ground a worker comes behind it and uses a steel blade known as a trowel to pack the rocks into the concrete so that they are not sticking out of the surface, this process is called hard troweling the surface and results in a dense concrete foundation that is strong with a smooth finish.

When we prepare concrete by acid washing or diamond grinding we are making the surface rough and exposing a portion of the solid rock below the surface so that the coating has something secure like a rock to hold onto. The thin layer of concrete between the rocks and the top surface of concrete is called laitance and is essentially made of sand that is glued together. Laitance is weak and brittle and must be removed in the preparation process. All concrete has some laitance but if the concrete was over watered by the installers in order to save money and stretch out the concrete then it will naturally result in a weaker concrete slab that contains more laitance. Brittle concrete is the reason why many floor coatings fail. This is why it is important to hire a wise and ethical builder to make your home's foundation solid and sound. An unethical builder will add too much water to the concrete so that he can make more money at the customer's expense. Doing this results in a weak foundation and compromises everything on top of it. If a coating peels and there is concrete stuck to the back of the coating then the failure was not due to a lack of adhesion on the coating's part, but rather the concrete foundation failed and broke away from itself. For example, if you coat a sandbox with epoxy and then you walk on the epoxy it will crack and peel with sand still stuck to the back of the epoxy that peeled. These types of failures are not the coating's fault because the coating did its job, it stuck to what it was supposed to.

Although brittle concrete is a common cause of coating failures, there is a more common cause. According to Sherwin Williams: "as high as 80% of all coating failures can be directly attributed to inadequate surface preparation that affects coating adhesion." 80% that's a staggering number. That means that 8 out of 10 garage floor failures are because someone didn't prepare the surface adequately. Floor coatings which include epoxy, urethane, or acrylics will not stick to a smooth object, they need something rough to grip onto. The rougher the surface the better the potential adhesion. But you don't want to prepare the concrete to a rougher degree than you can afford, because if you make the surface of the concrete too rough it will cost you more money in coating than you can afford to level the surface back out because when you make the floor rougher you have to use more coating. That's why

there are different concrete preparation techniques. If you are going to apply a thin coating you only need to lightly profile the concrete with acid. If you are going to install a medium thickness coating you need something more aggressive than acid washing to hold that coating into place, so you'll most likely want to diamond blade grind the surface for a medium concrete surface profile. If you want to install a very thick coating you will need to shot blast the surface for a heavy (very rough) concrete surface profile. The roughness of the floor needs to be proportionate to the thickness of the coating being applied.

When I started installing garage floors in the summer of 2003 I used Home Depots Rustoleum Epoxy Shield garage flooring box kits. It was inexpensive and readily available at the home depot. The kit came with just about everything that I needed, about a gallon of epoxy, 1 pound of decorative chips, and some acid powder in a little baggy that I would mix with water to etch the concrete surface before power washing. The kit didn't actually come with everything that I needed, it didn't include roller covers, roller frames, a pole to attach the roller frame onto, paint trays, brushes, buckets to mix the coating with or a power washer to profile the concrete with after acid washing. Typically speaking if you don't acid wash but just use a power washer on concrete it doesn't make the surface rough enough for a floor coating to stick to. That's what the acid is for. If you pour acid mixed with water over the surface of concrete the acid will chemically react with the alkali based concrete and cause it to shatter or loosen the sandy top layer (laitance) of concrete so that you can easily knock it off with a pressure washer afterwards and expose a light concrete surface profile. But you have to pressure wash the concrete afterwards otherwise you are going to apply a coating over a bunch of sand that you just loosened. Acid washing without power washing afterwards is counterproductive. It actually causes more harm than good.

After I acid washed and power washed my garage floors I was left with a light concrete surface profile. And that was well and good with the gallon of epoxy that came with the Home Depot Box Kit, but that's not actually a lot of product. On the contrary it is the bare minimum necessary to stretch across a 2 car garage and I mean stretch because you have to put real effort into stretching a gallon of watered down epoxy across the surface of a 2 car garage floor because if you're not really trying then you won't make it across the whole floor without running out of epoxy. I remember the first time I tried to install a gallon of that epoxy across a garage floor, I didn't even get half way before I ran out, it was embarrassing.

So after I learned how to manage the amount of coating Rustoleum was putting in their garage flooring kits my customers were ending up with a really thin floor. Considering the epoxy was watered down by a factor of about 50% my customers were only getting about 2 thousandths of an inch (2 mils) of floor after it dried. This is about the same as a really thin coat of wall paint, so you can only imagine that vehicle and foot traffic is going to wear thru that in no time at all. I was looking at an average service life of 1 year. I know this because I started installing garage floors for friends and neighbors whom I could visit later to see how the floor was holding up. Of course my friends weren't upset with me for the floors that wore thru to the concrete after 1 year, they knew they were buying Home Depot epoxy. Actually, they were the ones who bought the epoxy kit, brushes, rollers and buckets I just showed up to do the labor. This was the safest way for me to learn how to do the floors without risk. Of course I didn't make much money but I figured it was sort of like going to school or an internship. I was interested in doing this professionally so after I saw the kits from the Home Depot were only lasting about a year I figured there had to be a better way. So I eventually started putting 50% more epoxy on. I would buy two kits and use half of the second kit so that I didn't have to stretch the floor so thin for a thicker floor. But it doesn't take a rocket scientist to figure out that if 2 dry mils of coating lasted 1 year then 3 dry mils would only last 1.5 years. As I put the coating on thicker I started to get some phone

calls about peeling. Not a lot, but just enough to let me know that as I was increasing the thickness of the coating to 3 dry mils I was going to also need to get more aggressive with my preparation. Essentially too much floor coating was on top of the concrete and not enough was inside the profile of the concrete, sort of like a tree with shallow roots that tips over too easily. So I started to buy muriatic acid for swimming pools and used it to acid wash the floors with instead of using the little bag of acid that came with the box kit. It made a huge difference. Power washing after acid washing removed much more sand from the surface of the concrete and gave me a rougher profile than what I was previously getting. But the rougher the floor got the more coating I needed from the Home Depot. So I began to use 2 kits of epoxy for a garage floor after which doubled my cost but it was what I needed to stretch across the surface because when I moved up to muriatic acid I had to start stretching the 1.5 kits of epoxy thin again.

Eventually home depot started to sell containers of decorative chips by themselves which meant that my customers could buy more chips to put into the floors, and this was a hit! It was difficult trying to get the little baggy of chips that came with the epoxy box kit to stretch across the floor in an even manner without running out just like the epoxy. I can remember a few times running out of chips before I got to one side of the garage or accidentally throwing handfuls too heavy so that the floor looked blotchy and clumpy. Having more chips available really made a difference and helped make the floor look better and not so cheap looking. In my mind I had dreamed of buying enough chips to saturate the floor completely but I didn't know where to get that many chips or where to find a clear coat that was thick enough to cover them.

With more chips came the necessity for clear coat. The box kits didn't come with clear coat. Rustoleum didn't even sell one at the time. Behr (a different company) sold a wet look concrete sealer at the Home Depot next to the epoxy. Sometimes people would buy it and have me install it the next day over the epoxy and chips. It was really watery so it wasn't a thick product, it was more of a sealer, but it did provide a thin film with a nice sheen. I actually started to highly recommend the clear coat because I noticed that if you didn't get it the chips would stain very easily especially where the tires from the vehicles drove. The chips are not actually a true plastic, they are a porous vinyl that easily stains. Eventually I made the clear coat a requirement because, I had too many people upset with me that I didn't force them into buying it from the beginning after their floors stained. This was a big lesson for me because I had actually warned these people that they should spend the extra money on the clear coat but people repeatedly came back from The Home Depot without the clear coat because of the cost. Deciding to make the clear coat a requirement for my customers was a major fork in the road for me. I had to make a choice, was I going to provide a low quality product by installing floors with no clear coat and make more sales volume (money) or was I going to provide a higher quality product and separate myself from the competition knowing that it would reduce my sales volume (money) by requiring clear coat to be purchased at the risk of losing customers? Most people told me to offer both, but as I learned with the unreasonable people, they negatively effected my reputation even though I had warned them of the side effects of not getting clear coat even though they had agreed to buy it from the store. The question I had to ask myself was: Is it viable to risk my reputation in the long run in order to make more money now? I decided that it wasn't, because I wanted to do this for life and I wanted to be the best, so in order to prevent customers from not getting what was necessary I started to buy all of the materials myself and sell it as a package deal.

After I moved to 2 kits of epoxy per garage floor and the muriatic acid I was getting a 2 year service life since the floor was 2x times thicker (4 dry mils) but I started to notice two major problems with the acid washing. The first one was that the acid water running down and out of the garage floor would leave slight discoloration (burn marks) on the driveway as it ran down the driveway and into the street.

Since it requires so much water to acid wash and since garage floors are naturally made at a slope it is physically impossible to acid wash a garage floor without getting acid on the driveway thanks to gravity. You can soak the driveway with clean water first to mitigate the burn but it doesn't stop it. I wasn't previously having this problem with the Rustoleum acid bag that came with the kit because the acid they provided was so weak. I didn't see the problem until I need the muriatic acid. So I knew that I had to find another way of preparing concrete. Besides, I wasn't happy with 2 year garage floors anyways, I wanted a more permanent solution (a thicker floor) that required more of a profile. The second major problem I was having with acid washing was water retention. You can not apply epoxy (even if it is water) over damp concrete. That meant that I had to acid and power wash on day one, apply fans, then come back on day two to apply the coating. But sometimes the floor would still be slightly damp when I returned. This meant I would sometimes have to come back a third day to install the epoxy which people didn't like since they had all of the stuff from the garage sitting on the front porch. Plus epoxy takes 24 hours before you can walk on it and 72 hours (the 4th day) before you can drive on it or put heavy stuff on it, so people had their refrigerators and tool boxes and all their tools outside for a week. Besides that why would I want to add water to the concrete slab that could potentially migrate upwards later in the form of vapor anyways? When I switched to diamond grinding the floor the surface got so rough that the 4 dry mils of coating was not enough to level it out. I had to come back the next day and put down another kit or kit and a half (2-3 dry mils) on top of it in order to make the floor level. 6-7 dry mils is about what you need for a floor that has been diamond ground. But that's still only a 3.5 year floor on average.

At this point I was doing garage floors so regularly and using so much epoxy that I was constantly buying out all of the Rustoleum box kits from the nearest 5 home depots to my house. It was becoming a problem so I looked epoxy manufacturers and actually found one within 20 minutes of my home by the name of American Coatings in Tomball Texas. I started to use their industrial grade oil based epoxy and I used the chips from The Home Depot. The epoxy was much cheaper because I wasn't paying retail and it was a much better product with more shine that could be put down thicker which was nice because I needed the depth since I was diamond grinding now. The water based low solids Rustoleum epoxy was already being put down thicker than it should be at 4 dry mils thick which was slowing down the dry time and actually causing some shattering where it puddled in low spots in the garage floors. Typically speaking over the counter epoxy like the Rustoleum Box kits at The Home Depot only have about 50% solids which means they are about 50% water and should therefore only be applied at about 2-3 dry mils thick per each coat otherwise the water could get trapped inside while it dries on the outside and it will dry slower than typical and shatter or not cure properly. If you want to apply a single layer of coating thicker, lets say 4-6 dry mils then you would need a Higher Solids coating which has a solids content of about 60-90% and therefore less oil based thinner or water. Since High Solids material has less solvent it is less likely to get trapped in the drying process. The solids part of the material is what stays on the floor after it dries and the solvent is the water or oil based thinner that helps you deliver the material from the container to the surface of the floor in an easier manner so that it spreads out nice and level with minimal roller marks and keeps the material from drying too fast. The more thinner in the product generally speaking the longer you have to work with the product because all of the thinner (oil based or water) needs to evaporate before the solids part can dry. Home Depot is selling their epoxy to slow home owners who have no experience installing floors therefore they sell a low solid product at the sacrifice of a thicker floor. If you put down 10 wet mils of urethane coating and 75% of it is solids then that means that 25% is the oil based thinner or water which means the floor will dry to 7.5 mils thick. The Rustoleum epoxy from the Home Depot was water based and only about 50% solids. This meant that if I put down the coating at 4 wet mils then it would dry to 2 dry mils thick. The stuff I was buying at American Coatings was oil based and High Solids (about 66% solids), I put it down at about 7 wet mils thick and it dried to about 4 dry mils. I still needed two coats for my diamond

ground floors but I was having less of the negative side effects when the coating puddled in low spots. If you want to put down a coating thicker than 7 or 8 wet mils thick then you need a 100% solids product which are typically designed to be put down at 8-30 mils thick, but I wasn't ready for that yet. At the time I was content using High Solids for two reasons. The first being that American Coating didn't sell 100% Solids epoxy. The second being that I didn't mind doing the floor in layers which actually works just as good for partial chip floors if you don't mind coming back an additional day for each layer.

So I used American coatings for about a year until one Saturday morning on my way to pickup epoxy I saw that American Coatings was no longer there, it had burned down the night before. All that was left was a pile of charred metal that use to be a building.

So I went back to the home depot that saturday to get Rustoleum epoxy again because I had no other option and on Monday morning I called the nearest Sherwin Williams and asked them if they sold industrial grade epoxy. I knew they sold the kits on the shelf just like home depot did but I didn't want to go back to low solids material. They told me that if I wanted to buy industrial grade epoxy I would have to do buy it from the commercial store on Hempstead Highway and Longpoint Rd, they were the only store in Houston that sold it at the time. So I drove there and asked the manager for pricing on epoxy. He told me that he couldn't sell it to me anyways without going thru a corporate rep first. You see, since these materials are industrial grade they are actually very hazardous and dangerous to people who don't know what they are doing. Plus weather conditions and temperatures force you to make wild adjustment on how you store, mix and apply the coatings which is something that you can only learn by experience. Industrial grade floor coating material doesn't include instructions, they are subjective to your environment. So I had to get interviewed by a corporate rep before I could buy their industrial grade material. I passed the interview for the High Solids materials and I bought my first kit of Tile Clad High Solids Epoxy by Sherwin Williams. I loved it! It was even better than American Coatings and dried faster too. I could actually do two or three coats in one day which really cut down on my installation times since I was doing two coats and a clear coat for all of my floors at that point anyways. Even if you use 100% solids materials you can't just put down one thick coat because it would bubble on you, the first coat over concrete can only be applied at 4-8 mils max otherwise the gas (warm air) from the holes and pours in the concrete will not be able to break thru the coating and will create bubbles like the bubbles you get in pancakes while they are on the grill. This doesn't happen too much if you put down the coating in the middle of the night because the earth isn't warm at nighttime. This also doesn't happen if you don't do much preparation like when I was using the Home Depot acid bags because you don't expose many holes and cavities in the concrete surface if you don't prepare the floor aggressively. Every floor coating installer knows about out-gassing (the bubbles you get on a primer that is put down too thick) and knows that you put the first coat on thin enough to allow the gas to pass thru in order to prevent the bubbles and then after the primer dries and seals the pours your second coat can be put down thick. The exception to this is if you are fully saturating the floor with chips. If you are doing this then you can put the first coat down thick because when you throw chips into the surface they will pop the bubbles naturally just like your finger can pop the bubbles in your pancakes.

I used Tile Clad high solids epoxy from Sherwin Williams for a few years all the while learning about different products that Sherwin Williams had to offer, they eventually started ordering decorative chips for me in large 25 pound boxes which saved me lots of money. I was buying more Tile Clad epoxy than any company in Houston which included machine shops, oil refineries, and pipe painting companies which all used Tile Clad as it is also used on steel. My rep took me out to lunch often and let me demo different products that he wanted to sell me, I tried epoxies, acrylics and urethanes of all types. Every time I mastered one product I asked him to order me another because I wanted to know what was

special about each one and how to install it properly. I was sort of looking for my favorite material but I wasn't getting the look I wanted because none of the floors looked thick. One day while installing a garage floor a neighbor came over and struck up a conversation, he asked me if I did heavy chip floors and I told him that I had actually thought about that but that I had never actually seen one. He had one. I walked across the street and saw an amazing looking floor, it was like a sheet of marble or granite, totally covered with chips and a clear coat thicker than what I had been able to find. I had actually dreamed of seeing a floor like this and I will never forget the first time I saw one. I asked who did the installation and he told me that a company from out of state did it. He said that he had one in his old house but when he moved to Houston he couldn't find a company who did it so he hired an out of state company. I asked my rep about it the next week. He told me that I wouldn't be able to do it with the High Solids material that I had been using because it wasn't thick enough to hold that many chips. He told me that I would need to buy a material called 100% solids epoxy but he said he had been reluctant to sell it to me or mention it because it requires different tools and experience to install. Typically speaking the low and high solids epoxy that I was accustomed to installing could be mixed with a drill in a bucket and then I would take a 9" roller on a pole and dip it into the bucket and roll it onto the floor. There was no real rush to install the epoxy because it stayed wet in the bucket for about an hour which means it had a 1 hour pot life. A pot life is the amount of time a product can stay wet in a bucket before drying. 100% solids epoxy is much different, it must be mixed and poured out quickly otherwise it will combust (rapidly harden, get extremely hot, melt the bucket, and start smoking.) I found this out the hard way because that is precisely what happened. I was able to convince my floor rep that I understood the requirement to pour out the bucket onto the floor immediately after mixing it but after I mixed the product I realized that I didn't have the tools spike shoes to walk on the floor coating and spread it around. You see, if you dip and roll you can start painting in the back of the garage and walk yourself out the front without getting your feet on the wet epoxy floor. If you mix up 100% solids epoxy and pour it out on the floor you need special spike shoes to walk on so that you don't leave footprints while you roll the epoxy around the floor. I didn't think this thru the first time. I had already mixed the product so I was sort of stuck, so I decided to dip and roll like normal (at a much faster pace) so the coating didn't dry on me. But that still wasn't fast enough. So there I was dipping and rolling 100% solids epoxy in someones garage when I noticed the bucket start to smoke, so I figured I should start to hurry and when I dipped the roller into the bucket again, the epoxy had already gotten super thick because it was rapidly hardening and it grabbed my roller so I couldn't pull it back out. So there I was playing tug a war with my stick against a smoking bucket in some guys garage when the customer comes outside to ask if there was a fire, it was embarrassing.

Ironically 100% solids epoxy won't dry fast after it is poured out on the floor, it only dries fast when it is in a bucket with the force of itself pressing on top of itself creating combustion. 100% solids epoxy actually takes all night to dry after it has been poured out onto the floor which is nice because you can take your time throwing chips into the surface of the coating unlike 100% urethane which is the exact opposite. 100% urethane has a longer bucket life (about 30 minutes) but dries super fast after being poured onto the floor. 100% urethane dries so fast when poured out that you need one person pouring and rolling while another person throws chips right behind them. After 5 minutes on the ground 100% solids urethane would already be too dry to receive chips. That means you can walk on 100% solids urethane in about an hour or two. Having a floor that could be chipped and then clear coated and then walked on in a single day is attractive not to mention urethane is the ultimate floor coating.

After I had mastered my 100% solids epoxy floor application I felt better about my floors but I wasn't satisfied with the clear coat. I was still using a high solids urethane called Armorseal Rexthane which could only be applied at dry 3 mils thick (most urethanes can't be applied as thick as epoxy without shattering) and the chips pretty much soaked up all of the 3 mils of clear coat which meant the heavy

chip floors were still pretty rough. People often complained that they couldn't walk on the heavy chip floors with their sox on because the chips sticking out of the floor would snag them. So I started to offer two coats of Armorseal Rexthane but this was expensive because I had to come back another day and I was still only getting 6 mils of clear coat which didn't resolve the sox snagging. I did a floor with 3 coats which was about 9 mils thick once and I was happy with the result but not with the 4 day installation and the cost of 4 trips so I talked to my rep about an alternative urethane that could be installed at 10 mils thick in one layer. He told me about a material called polyaspartic which was a fast drying 100% urethane that could be installed at 10 mils thick, but he was cautious about selling it to me and warned me that it would probably beat me up like the 100% solids epoxy beat me up the first time I tried to use it. So after a lot of coaching he sold me a kit of polyaspartic 100% solids urethane and it was beautiful. It gave me the thick clear coat appearance I had seen in that first heavy chip floor a few years prior.

Things were good, I had finally figured out how to install a heavy chip floor with a thick clear coat, my installations were down to 2 days and my customers could walk on their new floors within 2 hours of me finishing and then drive on the floor in 48 hours opposed to 72 hours with the Rexthane. My customers could have actually driven on the floor in 12-24 hours had it not been for the epoxy underneath the urethane that I had installed the day before which required 72 hours before it can be driven on.

Up until that point I had always been told that urethane was better than epoxy in everything except for adhesion which was why epoxy had to be put down first and urethane on top. And this was true until they made a urethane that stuck better than epoxy. One day I was reading the data sheets on the new and improved 100% solids polyaspartic urethane that Sherwin Williams had been selling to me when I noticed that the adhesion strength directly to concrete was 425 pounds per sq ft vs 300 pounds per sq ft for the epoxy I was using, I was shocked! Typically speaking urethane data sheets don't show an adhesion strength because adhesion typically isn't a urethanes strength. Manufacturers have free reign to list the performance characteristics of their products as they see fit, so when I actually saw that the adhesion strength of the polyaspartic urethane that I was already using was greater than that of the epoxy I was using I felt like I had hit the lottery on accident! Not only was finding the strongest overall garage floor one of my goals but finding one with the characteristics of urethane (flexibility) was the other. You see, epoxy isn't flexible at all, it is rigid and brittle which means when you put it over cracks in concrete that are moving then the epoxy will buckle, crack and peel because it would rather brake away from the concrete than be forced to compress or stretch. 95% of the phone calls that I had gotten about floor coating failures had been in locations directly on top of cracks in the garage floor. You see, all concrete cracks move, they have to. If you have a crack down the center of your garage floor then you have two different concrete slabs, one on the left and one on the right. When it gets cold at night each slab shrinks making that crack between them larger. When it gets hot during the day the two slabs get larger and that crack shrinks. Most of my peels over cracks are during the heat of summer or the cold of winter because that's when there is the most stress on the coating that is bridging over that crack. But if you were to replace that rigid epoxy with a more flexible product like urethane you would significantly reduce the stress. But I hadn't been able to replace my epoxy primer up until that point because urethane wasn't typically recommended over concrete because it had previously never been manufactured in a way to yield a high adhesion strength.

After I replaced my primer with urethane the number of phone calls that I received about peels over cracks decreased ten fold. And my customers were pretty impressed with the 1 day installation. We are now able to grind the floor in the morning. Patch the concrete and install the urethane and chips into the floor in the early afternoon, and come back early evening to clear coat. Our customers can walk on the

floor the same day that we start the project (2 hours after installing the clear coat) and 12-24 hours later they can park their car on it.