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Gemmology Bulletin


# Rediscovering Synthetic Ruby: Part I

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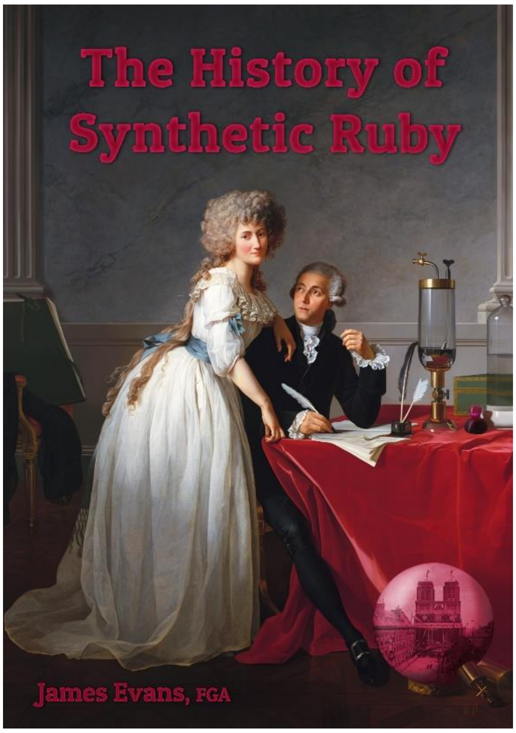


**'The History of Synthetic Ruby' (published January 2020).**

The first significant steps towards the synthesis of ruby were taken by Antoine Lavoisier in 1782. Following his invention of the oxygen blow-pipe, Lavoisier became the first person to fuse rubies together, and the first to synthesize corundum from powdered alumina (both ruby and sapphire are composed of corundum).

As outlined in *The History of Synthetic Ruby*, Lavoisier's method was to heat his samples on a burning charcoal fed with oxygen. In this bulletin we will be following three attempts to replicate his results.


**Lavoisier's first experiments were conducted with a large bladder filled with oxygen. This was attached to a blow-pipe via a stop-cock (to control the oxygen flow).**

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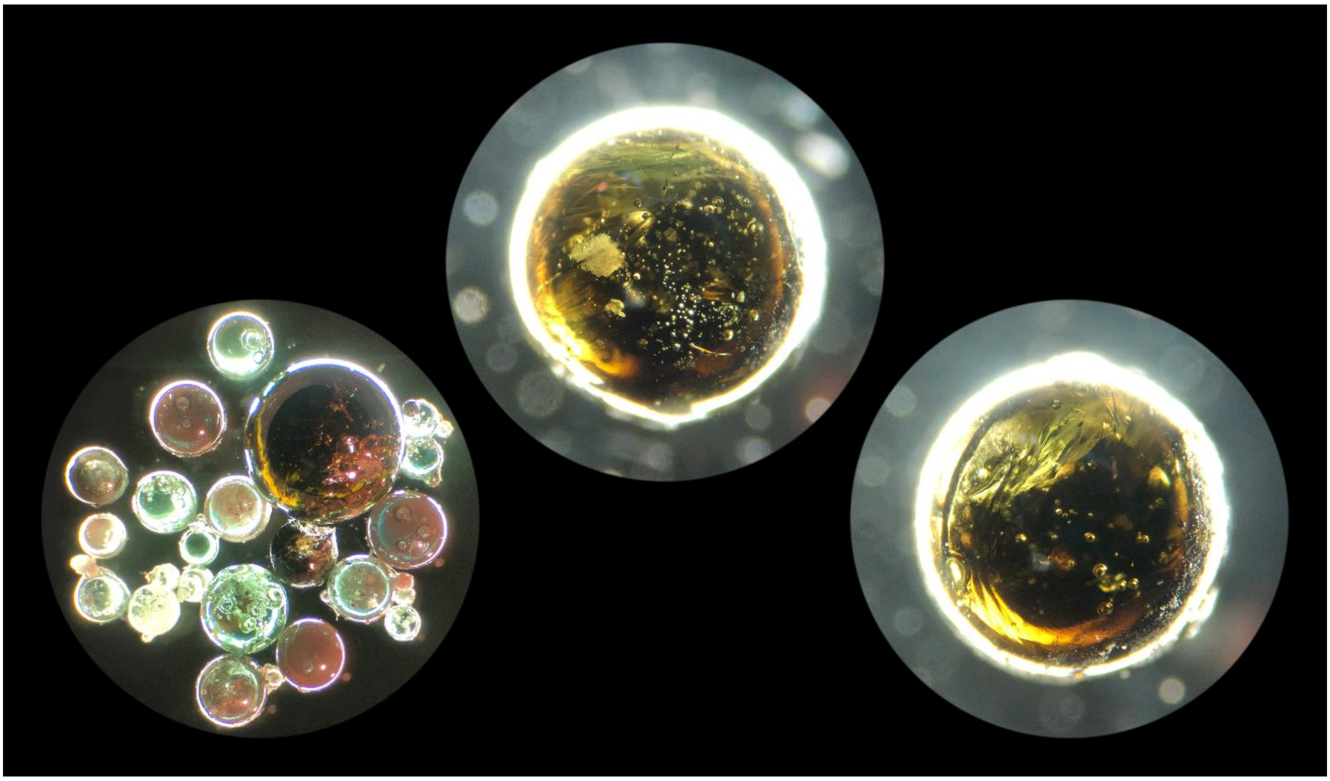
## The first attempt, using a block of coconut charcoal

The pictures below show a sample of alumina (aluminium oxide) heated on a block of coconut charcoal. Alumina melts at 2,044°C and will then crystallize to form corundum (also known as 'white sapphire') as it cools.

The result of this experiment was not corundum, but rather a ball of sintered alumina. Clearly the heat was insufficient! The brown patch on the side of the ball is silica glass; produced from impurities within the charcoal. Tiny balls of glass can also be seen on the surface of the charcoal.

## The second attempt, using a tube of sawdust charcoal

For the second attempt, the block of charcoal was replaced with a tube. The heat of this experiment proved sufficient to melt alumina. However, with significantly more charcoal being burnt, the corundum that emerged was covered in a mass of glass balls.



When viewed under a microscope, the glass displayed a range of vivid flow structures. Further tests found the balls to be optically isotropic, with an RI of approximately 1.58 (both typical results for glass).

With the alumina replaced by several small rubies, the heat of the experiment was found to diminish the stones' colour, but would not fuse them together. The resulting stones were of course covered in glass.

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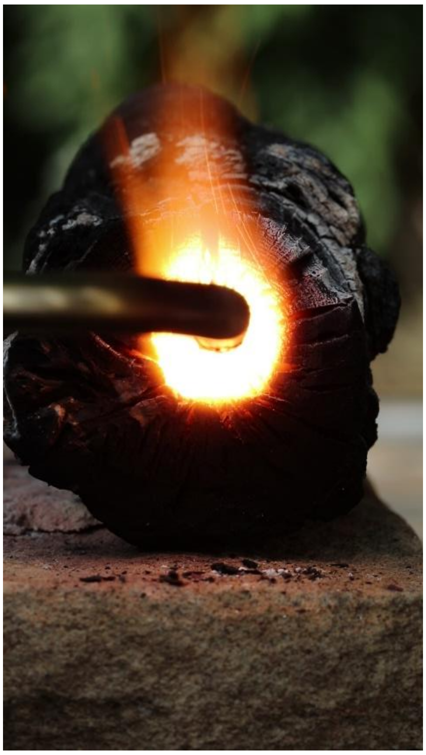
## The third attempt, using a log of hardwood charcoal

For the third attempt, samples were placed in the centre of a charcoal log. The heat produced was obviously greater than in previous experiments – so much so that the tip of the blowpipe was melted. A further benefit was that glass was no longer produced. Clearly the impurities that gave rise to glass were not present in natural charcoal.


The corundum produced in this experiment was able to scratch glass (a test for gemstones previously performed by Lavoisier). Using modern hardness picks, the stone proved difficult to scratch with even a Mohs' 9 pick. Furthermore, it matched the description of a 'milky white globule' (as described by Ehrmann after repeating Lavoisier's experiments in 1787).

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A further success was achieved with a light-pink Sri-Lankan sapphire. This crystal was folded in half by the searing heat of the experiment.

Finally, the experiment succeeded in fusing two rubies together. The fusion occurred at a particularly exposed portion of one stone, with the join taking on a dull, grey-green tone.

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# One final photograph: a ruby regaining its colour as it cools