

# Develop manufacturing capability of In-Ear Monitors

In-ear monitor are primarily used by musicians, artists and speakers to keep track of the sound while performing on stage. Owing to the superior quality of audio these devices have found their way to audiophile market. Current project aims to develop a local ecosystem to produce IEMs which would eventually allow multiple design choices. Primary objectives of this project are as follows:

1. Develop manufacturing capability in India
2. Move away from Chinese dependency
3. Proprietary design and production process

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## Feasibility study

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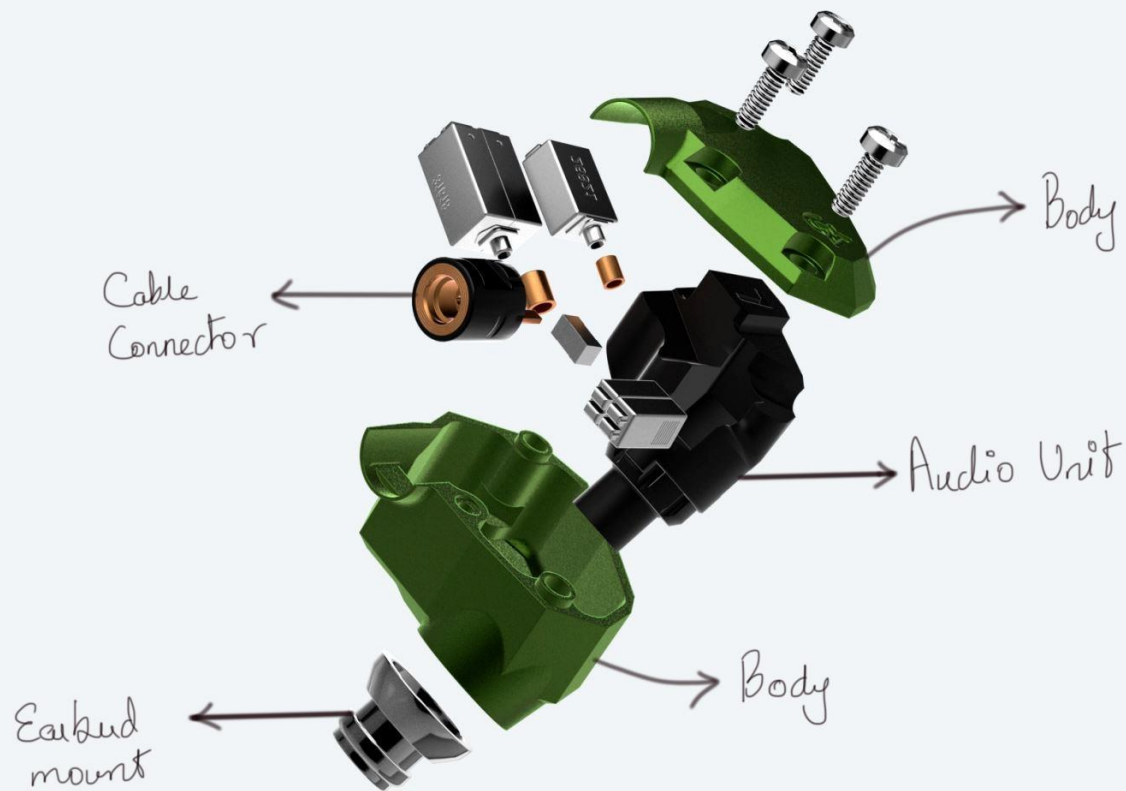
### Benchmarking

Universal fit IEM brands sold by Headphone zone.

1. Beyerdynamic	2. Audeze
3. Meze	4. Shure
5. Sennheiser	6. Noble Audio
7. JH Audio	8. Campfire Audio
9. Astell & Kern	10. iBasso
11. Audio-Technica	12. STAX
13. Dunu	14. Etymotic
15. BLON	16. CCA
17. Fearless Audio	18. HiFiMAN
19. Klipsch	20. KZ
21. MEE Audio	22. oBravo
23. RHA	24. Shanling
25. Tin HiFi	26. V-MODA

Considering the volume, cost and prospective target customer (an Audiophile) we have benchmarked beginner IEMs for the purpose of this feasibility study.

## Understanding the components



Sr No.	Components	Description
1	Body	Comes in different material offering like ceramic (Zirconia), metal and plastic
2	Audio Unit	Audio drivers vary in technology namely balanced armature, dynamic and hybrid drivers
3	Cable connector	2 pin connectors and MMCX type terminations are used
4	Earbud mount	This mount is mostly made up of stainless steel, it needs to be cleaned frequently for wax build up
5	Cable	Braided type is widely used form of the cable
6	Earbud	Rubber and custom foam buds are widely used

## How to Make in India?

As of this point the scope of design is limited to body and product packaging. Other components will be selected and combined to make a desired product.

Cables is a promising component design-wise, but parameters for development control are unknown yet.

### Body:

#### Plastic

Sr No	Process	Description
1	Material of construction	Plastic
2	Prototyping techniques	<ol style="list-style-type: none"> <li>1. SLA 3D printing</li> <li>2. HP MJF color 3D printing</li> <li>3. 5 axis CNC machining</li> </ol>
3	Production technique	<ol style="list-style-type: none"> <li>1. Injection molding</li> <li>2. Soft tooling</li> </ol>
4	Post processing	<ol style="list-style-type: none"> <li>1. PVD</li> </ol>

Plastic production is already a set industry to cater to every quality needs. For example, transparent plastic molding and machining is being in Automotive and lighting sector to make reflectors and lamp cover with high light transmission.

Design-wise plastic presents an advantage due to over-molding; rubber feature could be over molded on the plastic component.

Carbon fibre and leather could be used to enhance the features of the plastic product.

## Metal

Sr No	Process	Description
1	Material of construction	Metal
2	Prototyping techniques	<ol style="list-style-type: none"><li>1. 5 axis CNC machining</li><li>2. Wax 3D printing and investment casting in brass</li><li>3. Metal 3D printing</li><li>4. SLA plastic 3D printing to check form</li></ol>
3	Production technique	<ol style="list-style-type: none"><li>1. High pressure aluminum die casting</li><li>2. Metal injection molding</li></ol>
4	Post processing	<ol style="list-style-type: none"><li>1. Anodizing for aluminum</li><li>2. PVD</li><li>3. Plating</li></ol>

Jewelry industry is a relevant ecosystem to develop the product in metal, for more premium options Aerospace and biomedical ecosystem could be explore.

Like jewelry the metal body would have variety of color and finish options.

## Ceramic

Sr No	Process	Description
1	Material of construction	Ceramic (Zirconia $ZrO_2$ )
2	Prototyping techniques	1. 5 axis CNC machining
3	Production technique	1. Injection molding
4	Post processing	1. PVD

Zirconia machining is a widely used technique for making dental crowns in India. Industry is very niche. Though a similar metal 5 axis CNC machine used for zirconia milling but the make a build quality of the machine is different.

Zirconia CNC machine can mill a metal component, vice versa may not be true.

At this point, size of the standard blank available for dental crowns may or may not be used for the IEM body.

## How to proceed with the design process?

STEP 1: Select and purchase a type of cable and cable connector

STEP 2: Select the Audio driver

1. Balanced armature (BA) and number of BAs
2. Dynamic driver
3. Hybrid driver

STEP 3: Select the material of construction for the body

STEP 4: Design