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# CASTING METALLIC GLASSES

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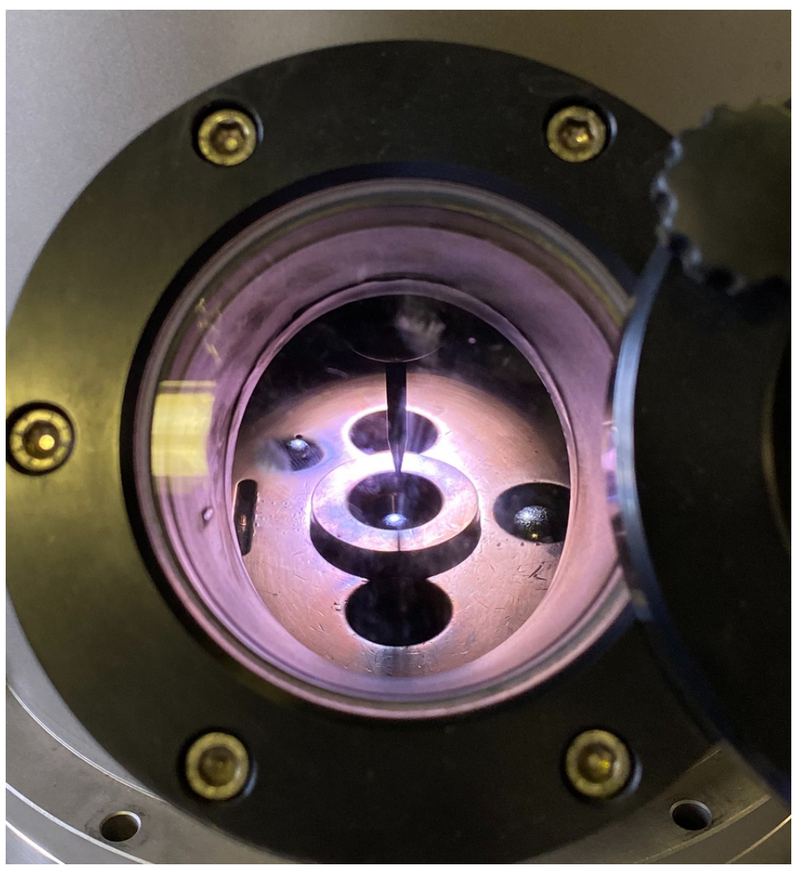
## INTRODUCTION

*Metallic Glass (often referred to as "amorphous metals") are noncrystalline alloys which form their atomic structure directly from the liquid state. Creation and use of metallic glasses has been reported since the 1960s but it isn't until the 1980s where they have seen significant applications. Due to its noncrystalline structure, its mechanical properties have been found useful for space applications. By using an Arc Melter it is possible to cast these metallic glasses in bulk and dispatch them to a third party to fulfill its intended utilization.*



## METHODOLOGY

*An alloy calculator pictured below is used to ensure the cut elements add up to create the desired mass ratio. These cut up samples are placed into the Arc Melter (filled with Argon gas in order to ensure a clean environment) and melted into a cast to achieve its required shape.*

| Element | Atomic Percent (%) | Target Mass (g) | Molar Mass (g) | Required Mass (g) | Req. Mass from single Element Mass (g) | Mass percent (%) | Est. Alloy Density (~g/cc) |
|---|---|---|---|---|---|---|---|
| Summa : | 100 | 12 | | 12.000 | 11.9806 | 100.00 | **6.40** |
| Zr | 60 | | 91.2242 | 8.5081 | 8.4943 | 70.90 | *4.03* |
| Ti | 2 | | 47.867 | 0.1488 | 0.1486 | 1.24 | *0.05* |
| Nb | 2 | | 92.9063 | 0.2888 | 0.2884 | 2.41 | *0.21* |
| Ni | 10 | | 58.6934 | 0.9123 | 0.9109 | 7.60 | *0.68* |
| Al | 7.5 | | 26.9815 | 0.3146 | 0.3140 | 2.62 | *0.07* |
| Cu | 18.5 | | 63.546 | 1.8274 | 1.8244 | 15.23 | *1.36* |
| - | 0 | | 0 | 0.0000 | 0.0000 | 0.00 | *0.00* |

## RESULTS & DISCUSSION

*Pictured below is the metallic glass rod created. With this sample it is possible to conduct further tests on the alloy to discover its mechanical properties in comparison to other alloys. Due to the difficulty of cooling the material before it can form its crystalline structure, real world applications for it are still very limited. Despite its small size, its value to organizations like NASA is significant as it can provide relatively double the performance of titanium in space applications.*