

AMORPHOUS ALLOY

**AMLOY-ZR01**

## ENHANCE YOUR PRODUCT PERFORMANCE.

Amorphous alloys, also known as amorphous metals or metallic glasses, are undercooled frozen metallic liquids. They show material properties which normally exclude each other, i.e. high hardness and strength with high elasticity at the same time.

Amorphous alloys enable extended product lifetime through reduced abrasion and corrosion resistance. Through the high strength of the material, they also play an important role in miniaturization. Isotropic behavior enables the simplification of specifications and product designs.

At Heraeus AMLOY, amorphous alloys are processed by injection molding and 3D printing into near-net-shape components at industrial scale.

The zirconium-based alloy **AMLOY-ZR01** is ideally suited for processing in 3D printing using the selective laser melting process.

Complex geometries and also large component dimensions are realized by an isotropic material behavior. The material is characterized within the AMLOY alloy range by its good ductility.

Additive manufacturing of amorphous metals can be used to produce individual components as well as specific surface structures with extraordinary properties.



## CHEMICAL COMPOSITION

Element	Concentration (wt%)
Zr	balance
Cu	24
Al	4
Nb	2

## MAJOR MATERIAL PROPERTIES

- High strength combined with excellent elasticity
- High surface quality
- High hardness and low abrasion
- High corrosion resistance
- Biocompatibility
- Isotropic properties

## INDUSTRIES & APPLICATIONS

- Aerospace
- Consumer Electronics
- Industrial
- Lifestyle
- Medical Technologies
- Robotics
- Sensors
- Tool Inserts

## PHYSICAL PROPERTIES

Properties	Typical Value
Density (g/cm <sup>3</sup> )	<b>6.68</b>
Liquidus temperature (°C)	<b>920</b>
Solidus temperature (°C)	<b>870</b>
Glass transition temperature T <sub>g</sub> (°C)	<b>400</b>
Crystallization temperature T <sub>x</sub> (°C)	<b>475</b>
Crystallization enthalpy ΔH (J/g)	<b>-47</b>
Young's modulus (GPa)	<b>87</b>
Poisson's ratio	<b>0.35</b>
Bending yield strength (GPa)	<b>2.3</b>
Tensile yield strength (GPa)	<b>1.6</b>
Compressive yield strength (GPa)	<b>1.7</b>
Vickers hardness (HV5)	<b>480</b>
Vickers hardness (HV5)	<b>~ 1%</b>
Thermal conductivity (W/mK)	<b>~ 2,5</b>
Thermal expansion coefficient (1/K)	<b>10 - 12 x 10<sup>-6</sup></b>
Specific heat capacity (J/kgK)	<b>250 - 350</b>

## ADDITIVE MANUFACTURING

### Ideally suited for:

- Production of small to medium quantities
- Complex geometries and large component dimensions

### Advantages:

- Use of the material properties of amorphous alloys for weight-optimized design
- Heraeus AMLOY's unique process competence through in-house material production and printing process development

## INJECTION MOLDING

### Ideally suited for:

- High quantities
- Manufacturing within tight tolerances (± 10 µm)

### Advantages:

- Automated production process (24/7 possible)
- Very good surface quality (Ra 0.05 µm)
- Low shrinkage < 0.5%
- Alternative to machining or Metal Injection Molding

