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Title: Additive Manufacturing Overview

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Additive Manufacturing Overview

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6/11/2018

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What is additive manufacturing (AM)?

- A type of material creation that uses technology to create 3D objects layer by layer
- Many materials can be used, including plastics and metals

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- Most well-known type of AM is 3D printing

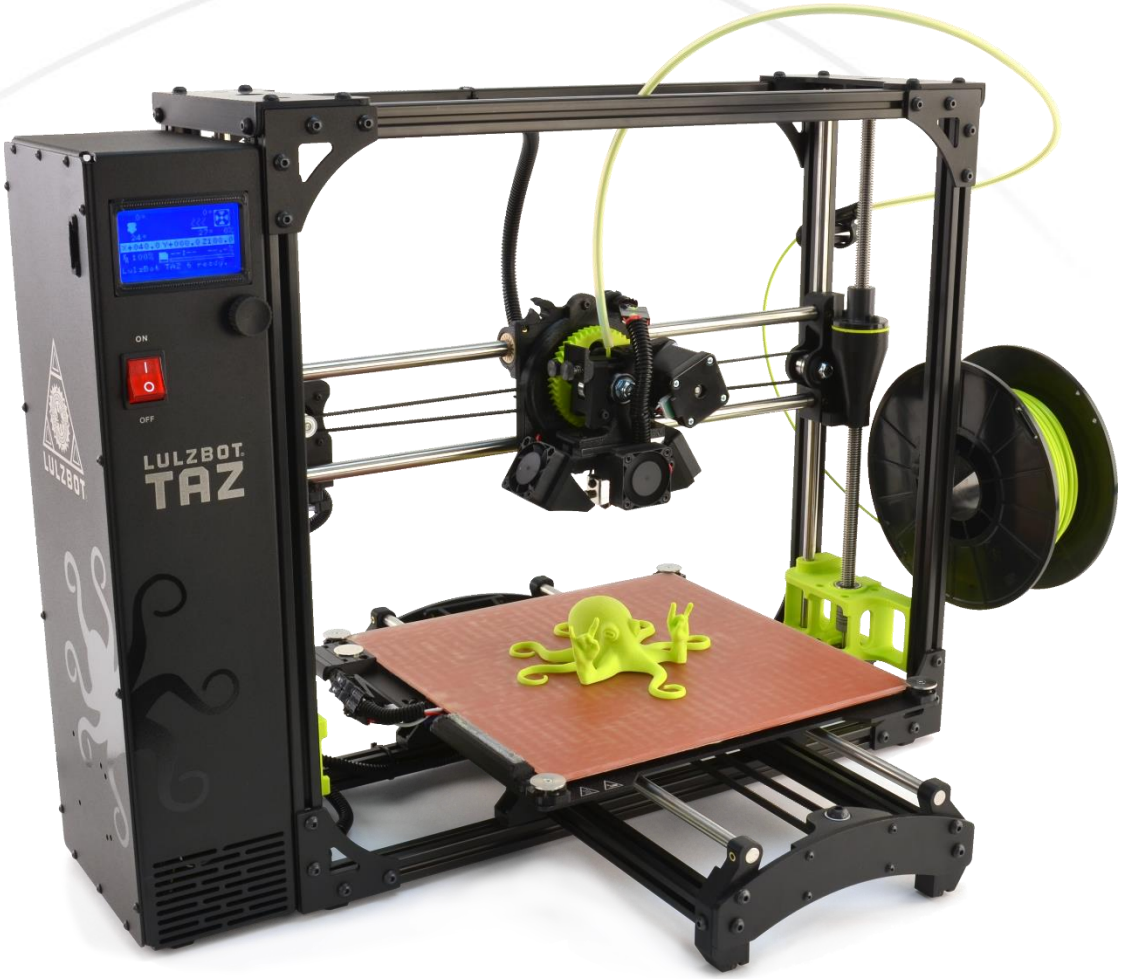

Image source: https://www.lulzbot.com/store/printers/lulzbot-taz-6

Metal AM Processes

- Powder layering
- Layers of powder 20-100 microns thick are melted together with an energy source
- Layers are added until the part is complete

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Metal AM Uses

- Aircraft
- Spacecraft
- Military

Source: http://www.3dprinterworld.com/article/department-energy-speeds-metals-research-with-3d-printer

Why use AM?

- Say you want to create a piece similar to this:

- How would AM make jobs easier in the aerospace industry?

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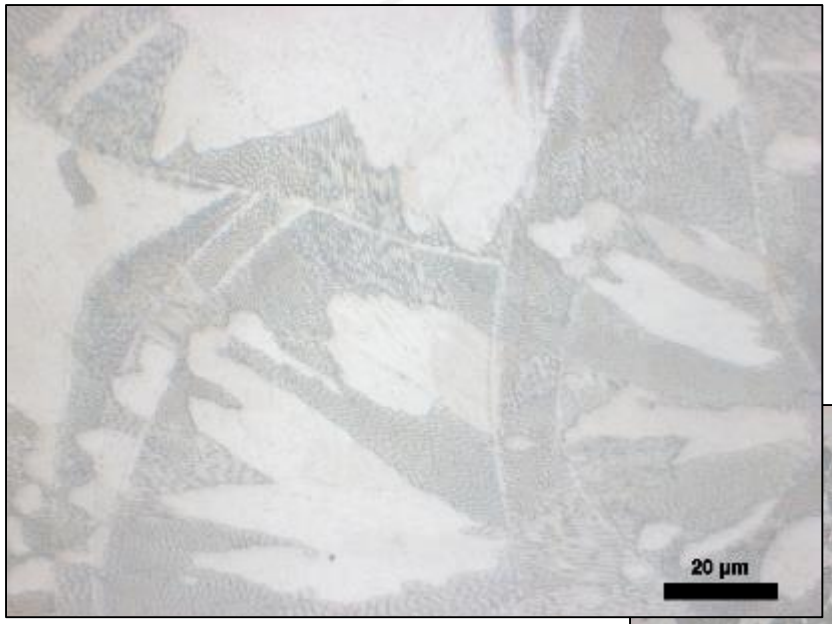
What have people made with AM?

Source: https://www.google.com/search?q=3D+printed+guitar&client=firefox-b-ab&source=lnms&tbm=isch&sa=X&ved=0ahUKEwia0sGb47_bAhUBBnwKHSwmBSQQ_AUICygC&biw=1920&bih=1091#imgrc=8ZMF_bOkCl9MIM:

Source: https://www.google.com/search?client=firefox-b-ab&biw=1920&bih=1091&tbm=isch&sa=1&ei=3DYYW5qVNMuH0wKQiK2oDQ&q=3D+printed+medical&oq=3D+printed+medical&gs_l=img.3..0l6j0i24k1l4.66432.69638.0.69862.18.17.0.1.1.0.136.1670.13j4.17.0....0...1c.1.64.img..0.18.1674...0i8i30k1j0i67k1.0.egAz49kDA60#imgrc=wVA_JE-nnt0uDM:

Source: http://www.designcurial.com/news/3d-printed-high-heels-when-fashion-and-high-tech-collide-4678427

How does LANL use AM?



- Stainless steel
- Aluminum
- Tantalum
- Titanium

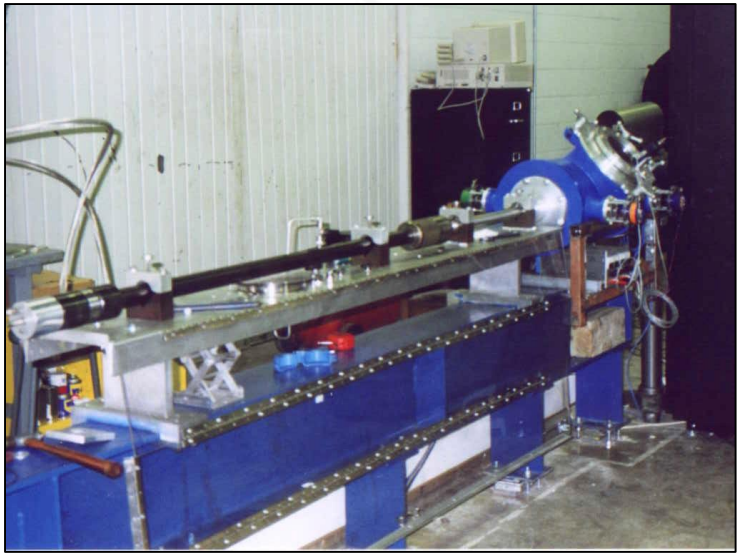
1000 um= 1 mm

Component Testing

Hopkinson bar

testing the dynamic stress–strain response of materials.

Gas gun



designed to generate very high velocities

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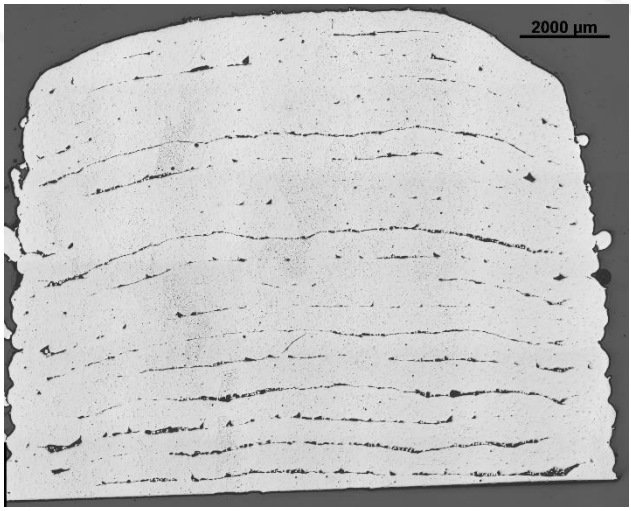
Metallography and Microscopy

1000 um= 1 mm



- Polish to a mirror finish
- Use acid to reveal microstructure
- Take high resolution, high magnification images using a light microscope
- Gather data on microscopic characteristics using a Scanning Electron Microscope
  - Microstructure
  - Orientation and texture

The Scanning Electron microscope (SEM) produces images of a sample by scanning the surface with a focused beam of electrons. The electrons interact with atoms in the sample, producing various signals that contain information about the sample's surface.

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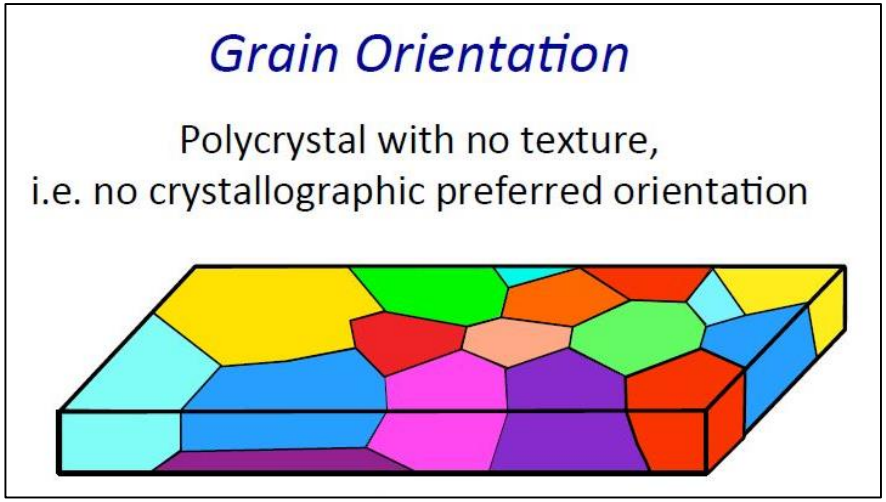
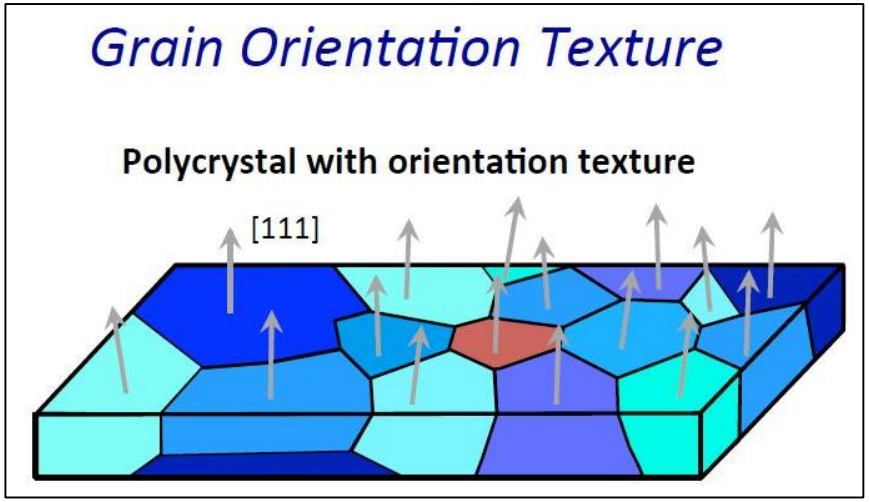
Grain orientation and texture

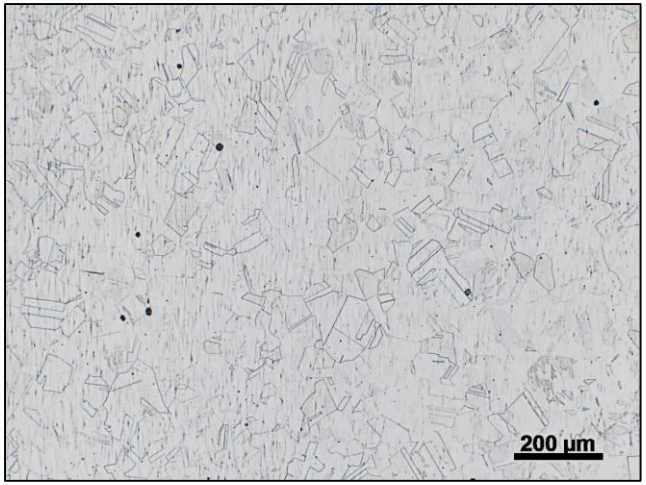




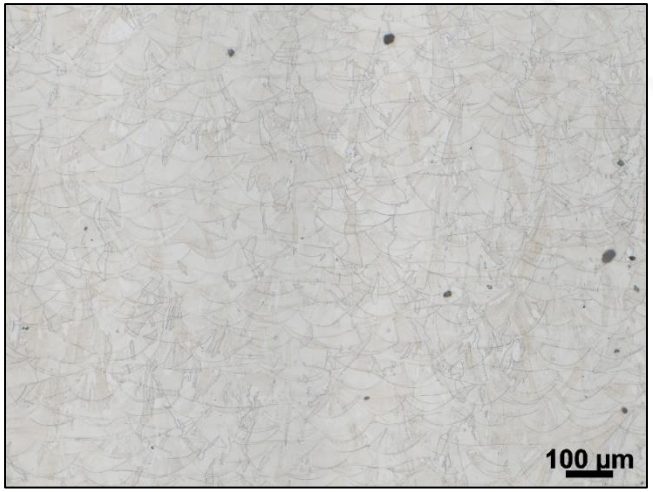
Images credit: T. Rollett

Problems

What we want

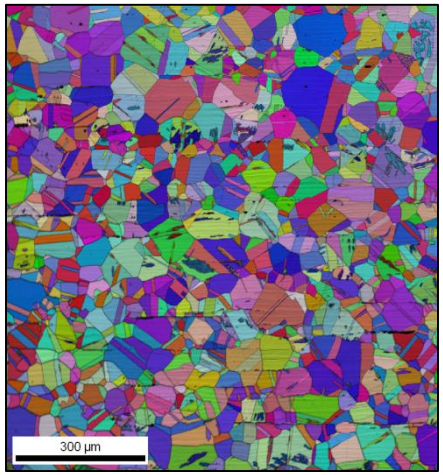


What we get

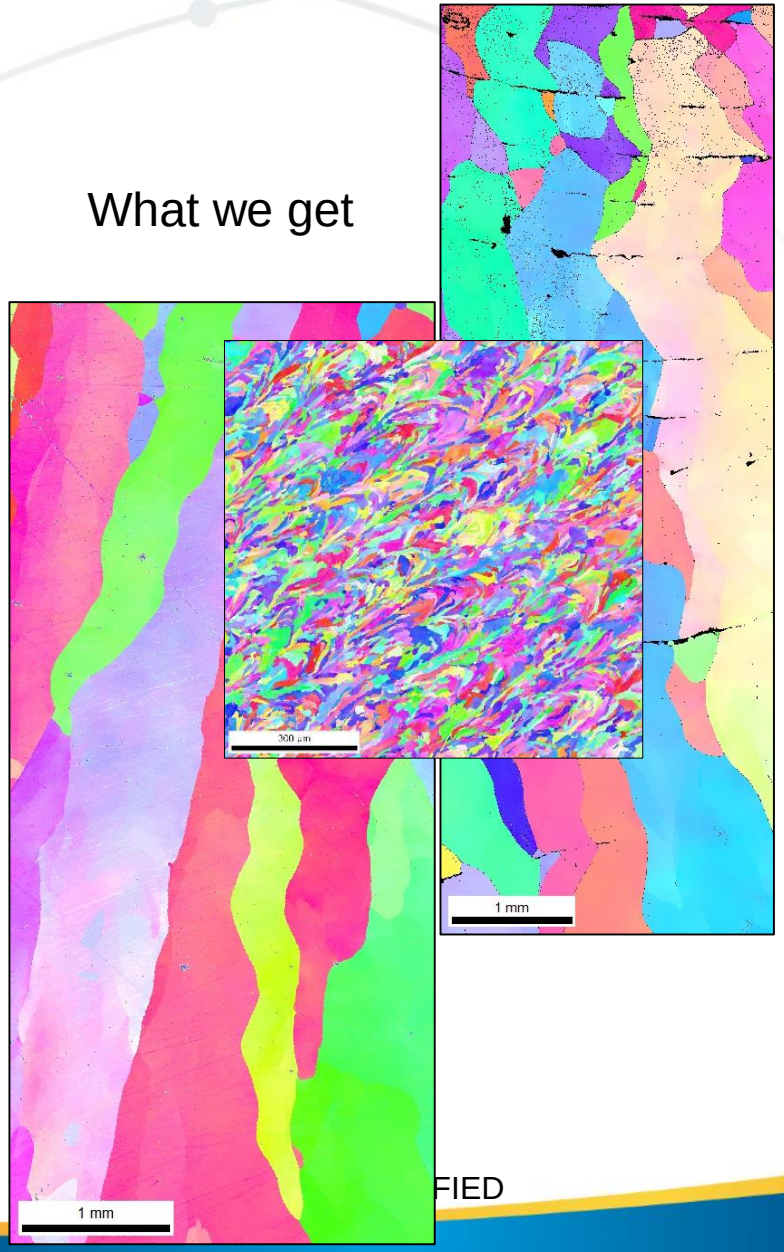


Problems

What we want



What we get



Why this matters

- Performance
- Application

- strength, toughness, ductility, hardness, corrosion resistance, high/low temperature behaviour or wear resistance

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Conclusions

AM is a great technology, if we can make it work!

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Questions

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"We are all stardust." ~ Carl Sagan

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