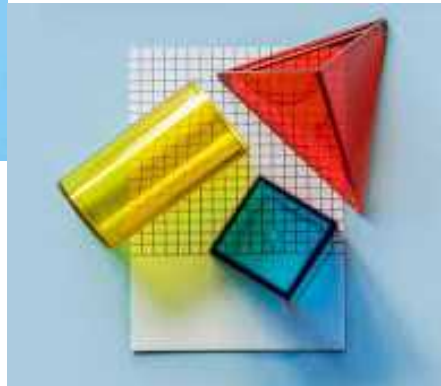




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3D printing technology aims students understanding maths and recycling procedure

*Curricula 1: 3D Printing Technology and Application
"3D Printing Materials"*

Output 3 (O3) - 3D Printing and Maths

Description



The capacities of the 3D printing cannot be independent of the used materials. Wide variety of materials are offered to create objects, such as jewels and several cases, while they differ in their use, texture etc. In this session the categories of 3D printing materials will be presented.

3D Printing Materials (1/2)



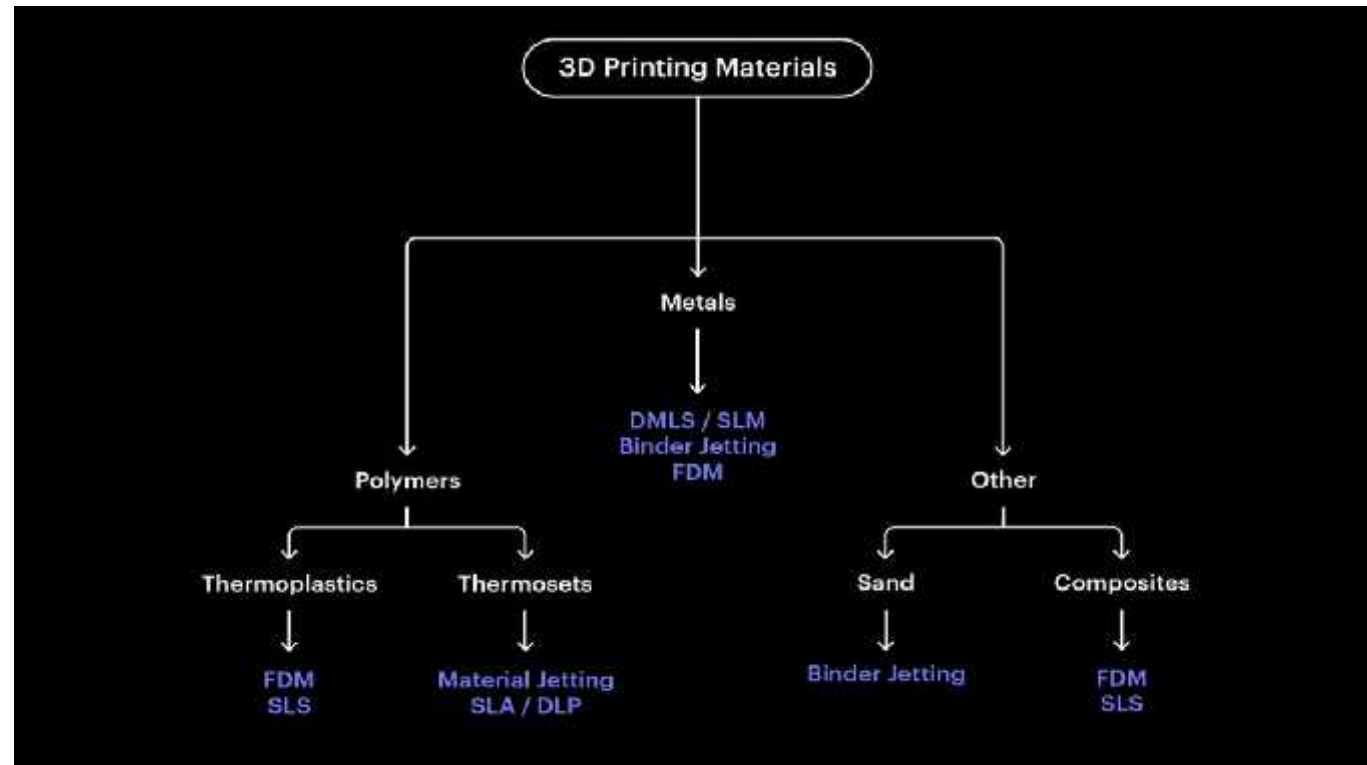
Selecting the optimal 3D printing process for a particular application can be difficult. There are often more than one process that are suitable and each of them offers different benefits, like greater dimensional accuracy, superior material properties or better surface finish.

- The required material properties: strength, hardness, impact strength etc.
- The functional & visual design requirements: smooth surface, strength, heat resistance etc.
- The capabilities of the 3D printing process: accuracy, available print volume, layer height etc.



3D Printing Materials (2/2)

- Plastics
- Metals
- Ceramics
- Wood
- Wax
- Paper
- Sandstone
- Composites



3D Printing Materials – Plastics (1/10)



- 3D printing plastics are lightweight materials with a wide range of physical properties, suitable for both prototyping purposes and some functional applications
- Plastics are either thermoplastics (with FDM or SLS), which are generally more suited for functional applications, or thermosets (with SLA/DLP or Material Jetting), which are generally more suited for applications that require good visual appearance
- Most of the thermoplastic 3D printing materials can be used in home 3D printing and professional applications alike

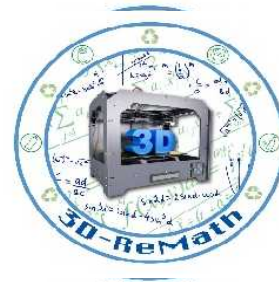
3D Printing Materials – Plastics (2/10)

- ABS

Remember the quality of Lego bricks?

Then you can relate to why ABS plastic is one the most popular 3D printing materials for desktop 3D printing today.

Price \$\$\$\$\$



3D Printing Materials – Plastics (3/10)



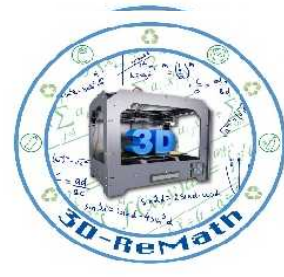
- PLA

The most common and low-cost 3D printing plastic. Ideals for non-functional prototyping with sharp details. Unsuitable for high temperatures

Price \$\$\$\$\$



3D Printing Materials – Plastics (4/10)



- Nylon

Nylon or polyamide (PA) is a plastic with excellent mechanical properties and high chemical and abrasion resistance. Perfect for functional applications

Price \$\$\$\$\$



3D Printing Materials – Plastics (5/10)



- Resin

Thermoset polymers that produce high detail parts with and smooth, injection mold-like surface. Ideal for prototyping

Price \$\$\$\$\$



3D Printing Materials – Plastics (6/10)



- PETG

PETG is an easy-to-print plastic with high impact strength and excellent chemical and moisture resistance. Good for mechanical parts with high impact resistance and flexibility. Sterilizable. PETG is a thermoplastic with improved properties over PLA, with high impact resistance and excellent chemical and moisture resistance. PETG can be sterilized.

Price \$\$\$\$\$



3D Printing Materials – Plastics (7/10)



- PET

The material water bottles are made of. This material is the second alternative to ABS. Unlike ABS, PET does not emit odorous fumes when melted but it is just as strong and flexible. More importantly, PET does not require a heated bed. This material has a glossy finish and is food safe which makes it a popular choice for many consumer products. Store PET 3D printing materials in vacuum bags or containers to protect against humidity

Price \$\$\$\$\$



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3D Printing Materials – Plastics (8/10)



- PVA - HIPS

PVA, like HIPS, is engineered for use as a soluble support material. While other support materials require special chemicals to dissolve, PVA is soluble in tap water. As with most of the other filaments, store it in airtight containers or bags

Price \$\$\$\$\$



3D Printing Materials – Plastics (9/10)



- PEEK

PEEK is one of the 3D printing materials designed for high-performance parts. Plastics of this family are highly resistant to stress, temperature, and chemicals. But that's not all: Parts made from PEEK can be exposed to X-ray and gamma radiation. In spite of its robustness, the material is easy to machine and fabricate. A 3D printer that can reach 400°C is needed in order to extrude this kind of material

Price \$\$\$\$\$



3D Printing Materials – Plastics (10/10)



- TPU

TPU is a thermoplastic elastomer with low hardness and a rubber-like feel that can be easily flexed and compressed.

Price \$\$\$\$\$





3D Printing Materials – Metals (1/7)

- Metals are highly used in aerospace, medical and automotive industries. Hence, the 3D printers using metals as a 3D printing material is equally important as the ones using plastic and other materials are
- These materials are supposed to print complex geometrical designs and produces great details with finer designs

3D Printing Materials – Metals (2/7)



- Stainless steel

Stainless steel is a metal alloy with high ductility, wear and corrosion resistance that can be easily welded, machined and polished

Price \$\$\$\$\$



3D Printing Materials – Metals (3/7)



- Aluminum

Aluminum is a metal with good strength-to-weight ratio, high thermal and electrical conductivity, low density and natural weather resistance

Price \$\$\$\$\$



3D Printing Materials – Metals (4/7)



- Titanium

Titanium is a metal with an excellent strength-to-weight ratio, low thermal expansion and high corrosion resistance that is sterilizable and biocompatible.

Price \$\$\$\$\$



3D Printing Materials – Metals (5/7)



- Cobalt-chrome

Cobalt-chrome (CoCr) is a metal super-alloy with excellent strength and outstanding corrosion, wear and temperature resistance. The material is best for high-performance applications. Most widely used for medical and aerospace applications for making turbines

Price \$\$\$\$\$



3D Printing Materials – Metals (6/7)



- Nickel

Nickel alloys are popular 3D printing materials for technical applications. Nickel alloy components made using 3D printing are stronger and more durable when compared to nickel alloy parts made using traditional techniques such as casting. This, in turn, allows engineers to make the components thinner, resulting in, for example, more fuel-efficient airplanes. There are many kinds of alloys that combine nickel's properties with those of other metals, like Monel or Inconel

Price \$\$\$\$\$



3D Printing Materials – Metals (7/7)



- Precious Metals (Gold, Silver, Platinum)

Most powder bed fusion companies can 3D print with precious metals such as gold, silver, and platinum. The challenge here, along with maintaining the materials aesthetic properties, is to make sure that none of the precious powder is lost. That's why you will mostly find parts that were made using the easier to control lost wax casting technique. Precious metals are used for 3D printing materials for jewelry, medical and electronics applications. Depending on the technology used, some of these materials also are cast

Price \$\$\$\$\$



3D Printing Materials – Wood

Although wood is not used in its purest form, it is one of the best 3D printing materials to provide wood finish to the parts printed. The wood fiber is mixed with plastic filament to provide it the necessary texture. When working with low temperature, it will get a lighter shade. On the contrary, when high temperature is used, it will be printed in dark brown shade. It is fragile

Price \$\$\$\$



3D Printing Materials – Ceramics



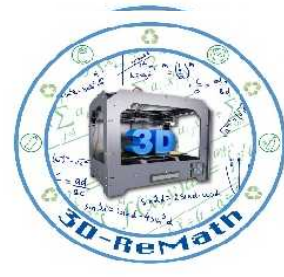
The most common example of ceramics application in the 3D printing of kitchenware.

After the part is printed using ceramics, it requires quite a job of post-processing. The properties of the parts include porous surface, fragility, heat resistance, etc.

Price \$\$\$\$\$



3D Printing Materials – Wax



Wax 3D prints are usually not the end product, but an essential stage in the production process. They are used to produce molds with stunningly high resolution (0.025 mm) for the lost wax casting technique of metal components. It is often employed to create customizable jewelry at a comparatively low price. The second industry that uses this kind of 3D printing materials is the dental medicine industry. You can 3D print complex structures that require supports by using waxes of different melting points and melting the supports off at low temperatures

Price \$\$\$\$\$

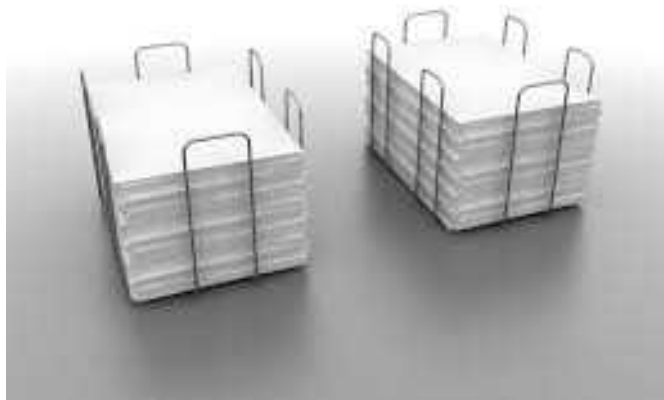


3D Printing Materials – Paper



With Selective Deposition Lamination (SDL) good old copy paper from the office store around the corner has found its niche in 3D printing. SDL parts have a wood-like feel and are fully colored, making them a popular choice for architectural and other conceptual models. On the downside, SDL parts are less durable than parts made of other 3D printing materials and you won't get the same level of detail as with materials like PolyJet Resins or gypsum

Price \$\$\$\$\$



3D Printing Materials – Sandstone



Variously referred to as “gypsum”, or “multi-color”, sandstone is one of the technologies in this 3D printing materials guide able to create spectacular full-color parts in one process. To enhance the quality of the colors and add strength the part is coated with a protective layer of epoxy resin (since sandstone parts that are exposed to water will discolor and leave you with a muddy white model). Also, components made from this material are as fragile as porcelain. Considering the finicky nature of sandstone, it comes as no surprise that it is mostly used for architectural models, conceptual prototypes and art projects

Price \$\$\$\$\$



3D Printing Materials – Composites



- **Metal / Plastic Filament** The “metal” filaments are actually thermoplastic that has been mixed with low amounts of metal. These 3D printing materials allow to 3D print components that have the optical properties of 3D printed metal

Price \$\$\$\$



- **Alumide** is a variation of nylon that has been combined with aluminum particles. In terms of durability and physical properties, this material is very similar to nylon. The difference is found in the shiny, durable and porous surface finish.

Price \$\$\$\$



Alternative 3D Printing Materials



Ashes



Beer



Cork



Sand



Flax



Sugar



Pasta



Bamboo



Crystal/Glass



Recycling and
Tires



Chocolate



Chewing gum





Thank you!!

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