

DOGBONE PRESENTATION

Polymer Clay

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What is Polymer Clay?

A type of hardenable modeling clay based on the polymer **polyvinyl chloride (PVC)**



How is polymer clay different from traditional ceramics?

Traditional ceramics are derived from natural clay materials like Kaolin. They are fired at much higher temperatures, on average more than 1000 °C higher, and typically result in a more brittle finish.

Let's learn more about polymer clay...

History and Development

1930's

First polymer clay was developed by German doll maker named Fifi Rehbinder, who called the plastic “Fifi Mosaik”

1964

Fifi then sold the formula to Eberhard Faber (Staedtler) who developed it into the brand, **FIMO**, that is still used today

1960's

American Zenith Products Company invented their own polymer clay, which eventually developed into **Sculpey**

2001

Polymer clay artist Donna Kato created **Kato Clay** in collaboration with the manufacturer Van Aken

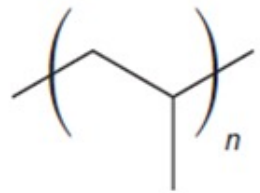
Consumer polymer clay industry is projected to reach 43 million USD in 2030

Structure of Polymer Clay

Flashback to my colloids presentation: polymer clay is a plastisol!

Plasticizers are added to PVC to make it soft. The two main types are phthalates and adipates

Colloidal dispersion of small **polymer particles** in a liquid **plasticizer**



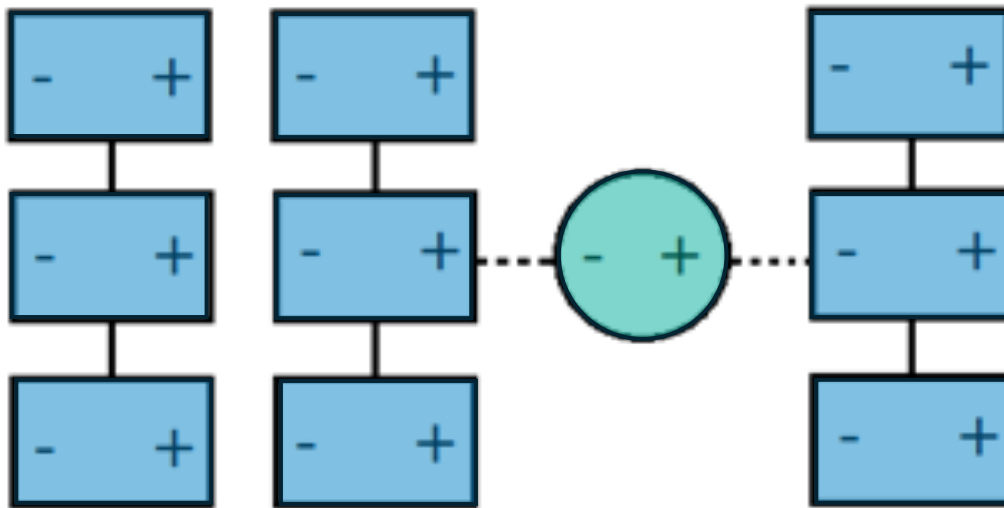
Poly(vinyl chloride)
(PVC)



How exactly do plasticizers affect polymer clay?

Structure of Polymer Clay

Plasticizers reduce the electrostatic forces between the PVC molecules



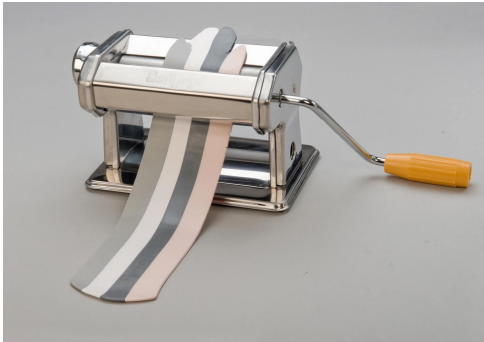
PVC molecules: rectangles

Plasticizer molecule: circle

- ✓ **Softening:** softens the material to improve workability
- ✓ **Flexibility:** counteracts the rigidity of the PVC
- ✓ **Workability:** prevents the polymer clay from drying out
- ✓ **Adhesion:** allows the clay to bond to itself and other materials

How can you process polymer clay?

Conditioning



Removes trapped air and makes the clay more workable

Shaping



Sculpting the final polymer clay workpiece

Molding



Using molds, or creating a mold from the original piece

**There's one more step to finalize the process...
Do you know what comes *next*?**

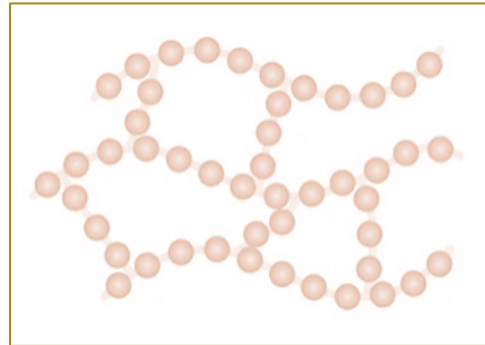
What is the curing process?

Heating



PVC particles in the clay begin to soften and fuse together

Cross-Linking



PVC particles start to cross-link, forming a solid structure

Cooling



After cooling, the polymer chains are locked into place

Baking polymer clay causes the plasticizer to evaporate, which hardens the clay into a solid structure

APPLICATIONS

Crafting and Prototyping

Ease of Use + Accessibility = Great Medium for Artists *and* Hobbyists

Figurines



Keychains

Earrings



... and more!

Crafting and Prototyping

Used for Prototyping Novelty Figurines, Models, Jewelry and even Cars!

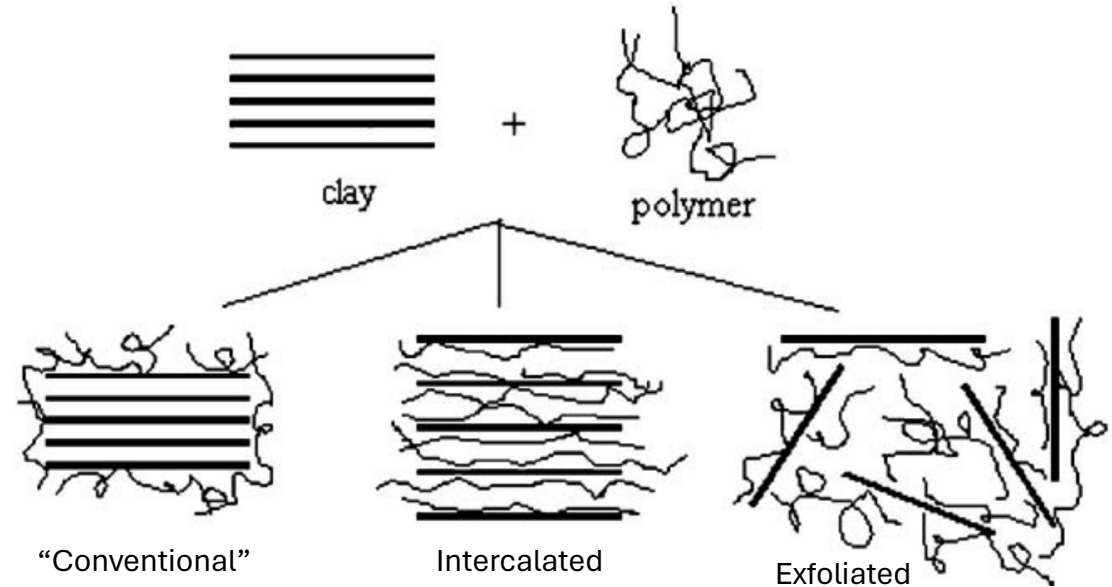


Clay artists conceptualize and design original figurines, sculptures or models, which are subsequently transformed into molds for mass production and manufacturing processes.

Polymer-Clay Nanocomposites

- ✓ Materials composed of polymer matrix reinforced with nano-scale clay particles
- ✓ Addition of clay nano-particles improves mechanical, thermal, transport properties
- ✓ Applications in automotive, aerospace, packaging, electronics fields
- ✓ Some research topics...

Understanding and tailoring polymer-clay nano-composite structure



Improving toughness of polymers after addition of clay, other properties, etc.

THANK YOU

Any questions?

(or requests?)