Polyacetics / Polyoxymethylene (POM)

Polyacetics (POM's) are highly crystalline thermoplastics that have mechanical properties similar to nylon. They are among the stiffest and toughest thermoplastics\(^1\). There are two types of polyacetal readily used in injection molding: homopolymer and copolymer.

In general, both types of polyacetics have the following properties\(^{ii}\):

- Highly crystalline; due to no large pendant groups on the chain.
- High crystallinity leads to excellent strength, stiffness, surface hardness, barrier properties, solvent resistance, and a sharp melting point.
- High crystallinity also leads to reduced toughness and they are somewhat notch sensitive.
- Good slip and wear resistance\(^i\)
- Normally not sensitive to polar solvents; hence low water absorption.
- Acetal is attacked by acids and strong oxidizing agents.
- Due to low molecular polarity, they have low bonding tendency and low coefficient of friction.
- Acetal is UV sensitive; chalking and degradation of the polymer occurs with exposure.

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\text{Acetal Homopolymer} \quad \text{Acetal Copolymer}
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Some comparative properties:

**Homopolymer**

- Homopolymer (commonly Delrin) is made by polymerizing formaldehyde.
- 15% higher tensile strength
- 20% higher modulus
- 20% higher impact strength
- 20% higher surface hardness
- 20% higher fatigue limit.

**Copolymer**

- Copolymer (commonly Celcon) is copolymerized with formaldehyde and ethylene oxide.
- Increased thermal stability; due to the C-C bond.
- More flexibility
- Twice the elongation
- 20% less water absorption.

Additives are available for polyacetics. Here is a short listing of some of the additives and their effects:

- Adding short fiberglass will enhance strength and toughness.
- Mixtures with fluorocarbons lead to good surface lubricity to prevent creaking\(^i\).
- Increase stiffness and strength; add 10-40% glass fiber, glass beads or other mineral fillers.
- For thin-walled parts – crosslinked rubber can be added to improve melt flow in the tool.
- Improved electrical conductivity and heat distortion point is obtained by adding powdered aluminum or bronze.
- Polyacetics have high mold shrinkage – warp\(^{iii}\). Adding talc filler (or other heat sinking inorganic filler) will reduce the amount of warp; however, it is at the cost of reduced impact strength.

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