

# BONLECULE FILAMENT

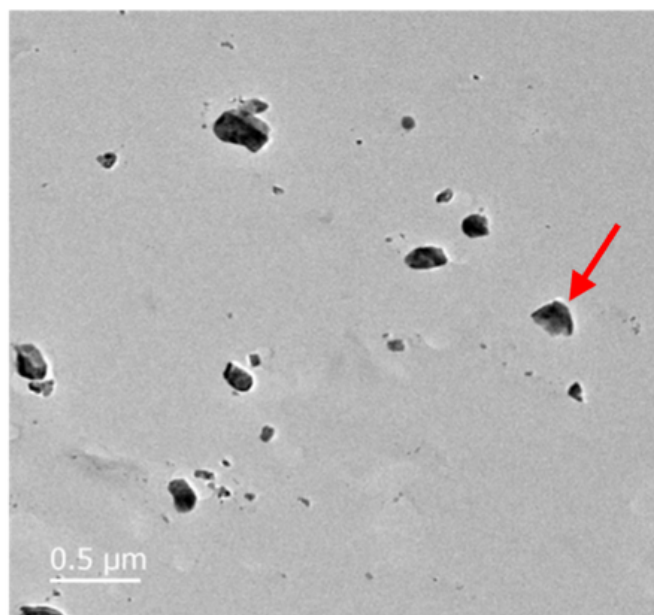
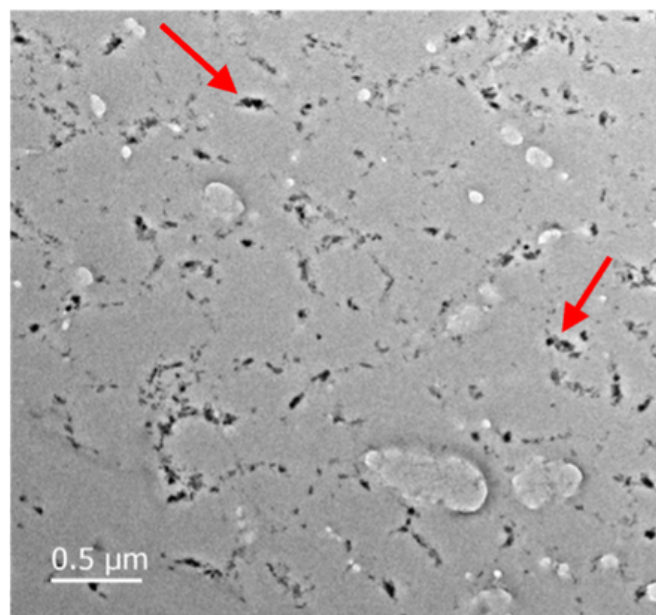
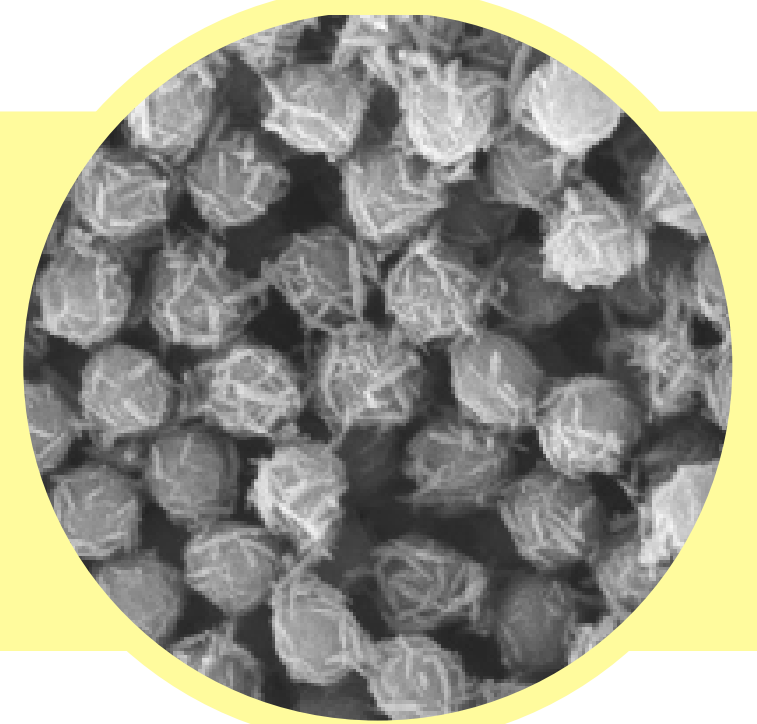
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LIFE SCIENCES

## WORLD 1ST BIOACTIVE 3D PRINTER FILAMENT

Bonlecule is a polymethyl methacrylate (PMMA) based 3D printing filament that is embedded with nano-hydroxyapatite (nano-HA) within the polymer matrix. This filament is scientifically designed to enhance osteoconductivity and printing performance, and it is manufactured in compliance with ISO 13485 standards, ensuring quality and reliability for implants and other medical applications.

### Bonlecule Composition

Unlike commercial nano-hydroxyapatite (nano-HA), Novus's nano-HA is uniquely structured, featuring HA crystals of approximately 20 nm that are chemically bonded to copolymer nanoparticles. This innovative approach significantly enhances the distribution of HA within Bonlecule, improving its performance in biomedical applications.

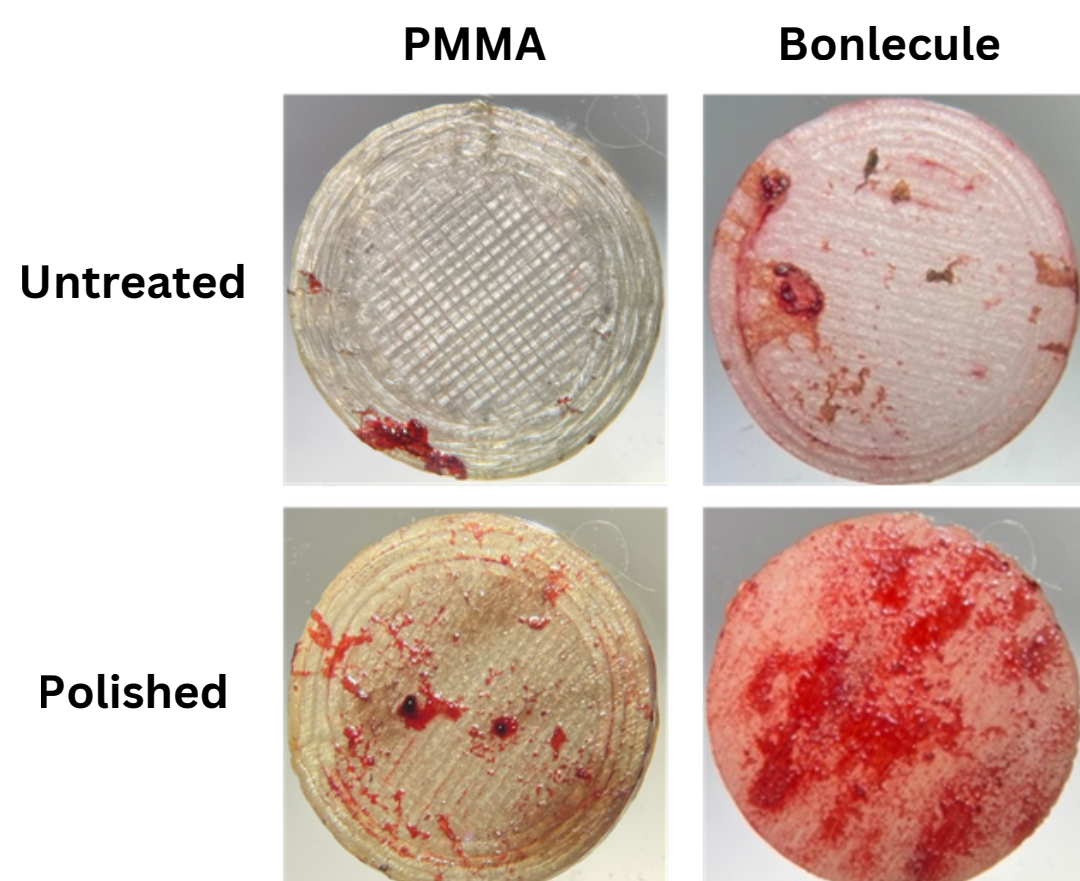
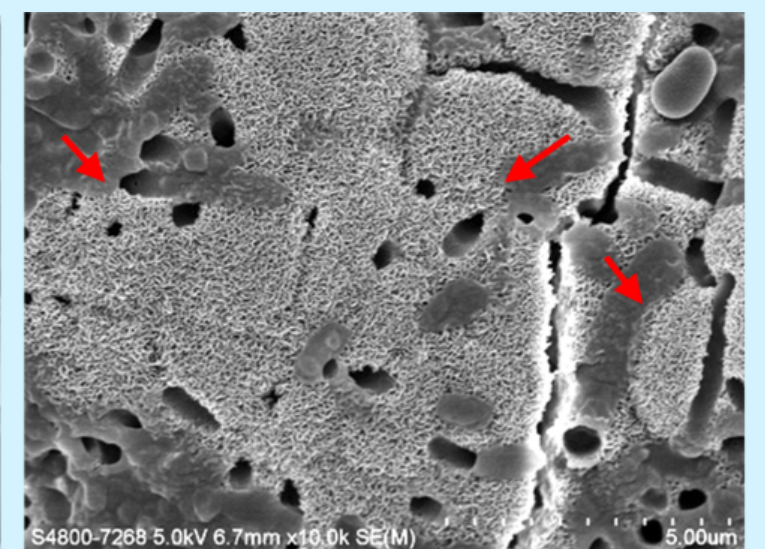
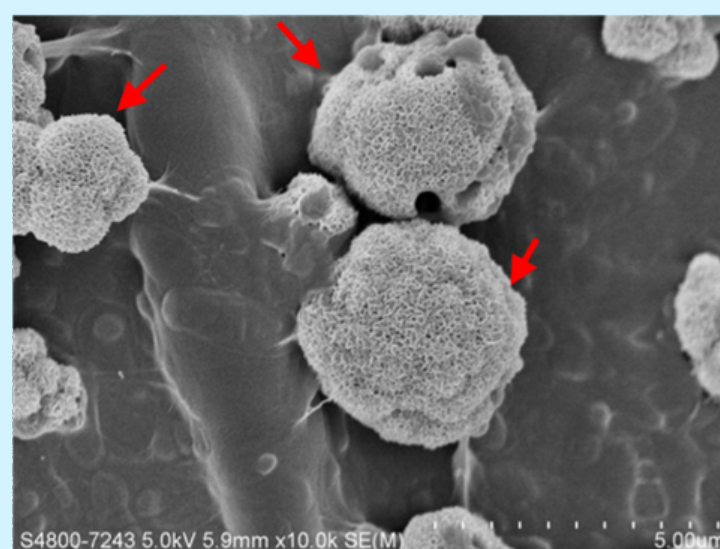


### Filament Characterization

The TEM images (5kx) show nano-sections from the (Left) Bonlecule filament and the (Right) PMMA filament containing commercial nano-HA. The dense black spots (indicated by arrows) represent the nano-HA, while the grey background illustrates the PMMA matrix. At the same weight percentage of HA in the filament, Bonlecule's nano-HA is more evenly distributed throughout the matrix.

### Bioactivity

The bioactivity of 3D-printed implants was evaluated through a 21-day simulated body fluid study. The SEM images (10kx) of both PMMA polished samples (Left) and Bonlecule polished samples (Right) revealed HA formation (indicated by red arrows). Notably, HA was more effectively integrated with Bonlecule substrate and was distributed more evenly across its surface.



### In vitro Mineralization

3D-printed samples were cultured with MC3T3-E1 osteoprogenitor cells for 28 days in osteogenic medium and stained with 40 mM Alizarin red S. The red staining on the surface indicates calcium deposition, which serves as a later stage marker of extracellular matrix mineralization. Bonlecule samples (right column) demonstrated superior calcium deposition, particularly on polished samples.

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