



# Hybrid Slip Casting/ Electrophoretic Deposition (EPD) Process for Creating 3-Dimensional Functionally Graded Materials

## An efficient, environmentally friendly way to improve manufacturing

Electrophoretic Deposition (EPD) is a technique that is used to deposit particles from a slurry under an external electric field. Ceramic, polymer and metallic powders have been successfully deposited using this technique.

Functionally Graded Materials (FGM) are composites in which the material composition varies with respect to 3-dimensional location. Composites are developed to obtain enhanced material properties. However, material interfaces can generate problems, especially residual stresses that compromise structure/component integrity and reliability. FGM enable smooth transitions between materials so residual stresses are minimized.

Dr. Eugene Olevsky, Distinguished Professor at SDSU, has developed a hybrid slip-casting/EPD technique that can be used to produce arbitrary shapes with controlled material properties. The shaped components can be metals, ceramics, polymers, or combinations as long as the material exists in powder form prior to deposition.

EPD processes can cause hydrolysis during deposition, creating bubbles that undermine the integrity of the material. Commonly, organic solvents are used to address this issue. However, Dr. Olevsky's method uses completely environmentally friendly materials and still prevents the problems associated with hydrolysis.

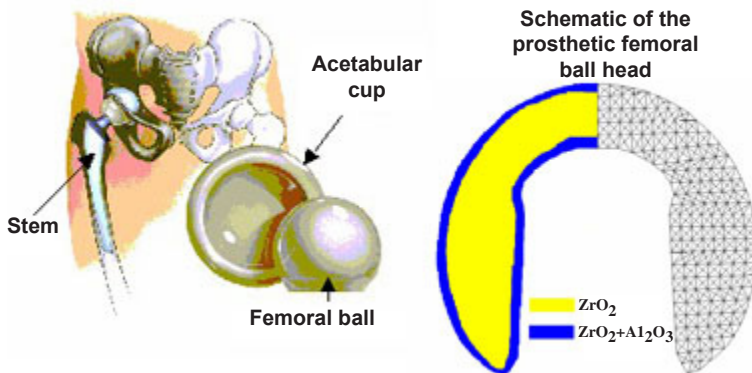
is much shorter than slip-casting and the process can be scaled up for high-efficiency volume production.

### Advantages:

- Enables generation of completely 3-dimensional Functionally-graded materials
- Completely environmentally friendly
- Can use any material that exists in powder form
- Prevents hydrolysis during formation
- Faster than traditional slip-casting
- Sintering process does not introduce cracks
- Algorithms allow precise design for final shapes after sintering
- Easy scaling for high-volume production

### Applications:

- Cooling contacts for semiconductors
- Prosthetic implants
- Coatings for bio-implants
- Aerospace materials
- Insulation and heat transfer



Compared to traditional slip-casting or EPD processes, this method enables a straightforward framework for tailoring material properties easily. The shaping process

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