

# Printing-Induced Particles Segregation Governs Anisotropic Sintering in Binder Jet Additive Manufacturing

Anisotropic shrinkage during sintering is limiting the widespread adoption of Binder Jet Additive Manufacturing (BJAM) by undermining its ability to produce near-net-shape parts. While emerging evidence indicates that powder segregation during BJ printing induces particle-size heterogeneities, its influence on the anisotropic sintering of BJ-printed samples has not been explored. This study investigates the relative effect of pore and particle size heterogeneities on anisotropic sintering by developing a digital twin model to simulate the BJAM process. The model captures the dynamics of particles during the powder spreading process, including particle segregation, using the Discrete Element Method (DEM), enabling spatially resolved representations of packing density and particle-size heterogeneities. It also simulates the sintering response using the continuum theory of sintering implemented in finite element (FE) codes. Capability of the developed model is verified and validated using experimentally measured results for binder jet printed samples from literatures. It is revealed that particle-size heterogeneities, caused by powder segregation during printing, govern anisotropic shrinkage during sintering of binder-jet-printed samples. The work highlights the need for optimizing feedstock particle size distributions and powder spreading parameters to control anisotropic shrinkage in BJAM process.

## Professional Status of the Speaker

Senior Scientist

## Interest in submitting a paper in a special issue of

No interest

## Invitation letter for visa

Yes

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