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Manipulation of liquid metal foam with electromagnetic fields – a numerical study

Summary
Metal foams are novel materials with unique properties such as low weight and high stiffness. Even so, they are not yet widely applied because they are difficult and expensive to produce.
In my thesis, I investigated the generation process of metal foam numerically. Special attention was paid to techniques of manipulating the metal foam in its liquid state with magnetic and electromagnetic fields. A magnetic field was found to hinder drainage and thus, homogenises the resulting foam. A strong electromagnetic field can compensate gravity and cause the bubbles to float and stir. This state allows for the production of metal foam with a user-defined gas volume fraction. Applying inhomogeneous electromagnetic fields it is even possible to control the distribution of gas bubbles in the resulting metal foam. Simulating the agglomeration of bubbles I unintentionally reproduced the self-organisation of bubbles in hexagonal close-packed and face-centred cubic arrangement. Investigating this feature I have been able to provide a long sought-after argument for the preference of face-centred cubic arrangement over the other.
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