第54回APMセミナー(臨時)開催のお知らせ

～先端フォトニクス材料ユニット～

Going with the flow: dynamics of metal foam films

Date: Friday, Aug. 9 th

Time: 10:00 – 11:00

Venue: 8th floor medium seminar room, Sengen

Speaker: Prof. Lucien N. Brush

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Our research focuses on understanding the microscale flow and interface evolution of liquid metal foam films in order to improve the processing of bulk metallic foam. Metallic gas-liquid foams are precursors to porous solid materials that are lightweight and useful in transportation, energy, medical and other applications. The crowded gas bubbles in a gas-liquid metal foam are unstable because of a strong capillary-suction flow, from the nearly uniform, thin lamellar films separating pairs of gas bubbles, into the highly curved Plateau border regions that are the intersection of three or more lamellar films. The liquid drainage leads to gas bubble coalescence and foam coarsening so rapid that, in practice, bulk metal foam solidification is not possible without liquid additives such as ceramic particles. In this talk, our calculations of the thinning, the onset of instability and the evolution to rupture of unstable foam films with Plateau borders in a pure gas-liquid metallic foam will be presented. Linear stability results show that a draining lamella with Plateau borders is more stable than a lamellar film without flow and without Plateau borders. Numerical calculations track film evolution to a time just prior to rupture. The effects of variations in the Plateau border radii of curvature, and of different initial conditions on rupture phenomena will be presented.

In practice, gas-liquid metal foams are stabilized against coarsening by the addition of particles. One effect of particle addition is the generation of an oscillatory-structural component of the disjoining pressure. By including the oscillatory-structural component of the disjoining pressure in our model, our research aims to understand the role of particles in foam stabilization, to ex-plain unique behaviors observed in particle-laden films, such as stepwise thinning, and to identify potential novel film or foam structures. To date, the results of our analyses show that a uniform film can spontaneously evolve into a multilayered film as a result of the particle additions. There is an analogy between phase transformation in a supersaturated solution as predicted by classical theory and the layering of a particle-laden film. A "phase" diagram that maps regions of stable and unstable films as a function of the disjoining pressure and the film thickness will also be presented.

【問い合わせ先】応用フォトニック材料G

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