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Electricity in foams: from one soapy interface to the macroscopic material

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Liquid foams (a dispersion of gas bubbles in a soapy solution) destabilize with time due to coarsening, coalescence and gravity driven drainage. We propose here to inhibit (or trigger) the foam destabilization by applying an electric field to the material. This effect is investigated at the different scales of the system: one soapy interface, one liquid film, the macroscopic foam. The generation of an electroosmotic flow near a soapy liquid/gas interface raises many issues. How does the flow affect surfactant repartition? Is there a Marangoni stress at the interface? At the scale of one soap film, how the electric field affects the film stability and deformation? In a macroscopic foam, one can wonder whether the electric field can indeed reverse gravity driven drainage and increase foam lifetime? These different issues are considered by developing new experimental techniques allowing us to probe surfactant repartition at liquid interfaces, soap film thicknesses and liquid foam properties when an electric field is applied. The results will be presented together with a comprehensive picture of the mechanisms arising at each scale of the material, to conclude with the potential use of electricity in liquid foams to control destabilization.
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