Optimization of Ferrofluid Foams Properties for Radioactive Decontamination

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After the Fukushima Daiichi nuclear disaster (Japan, March 2011), radioactive decontamination has appeared increasingly obvious for humanity. Is it possible to improve the actual processes to make them safer, faster and more economical? Liquid foams, already used, present certain advantages for this decommissioning: a less active ingredient is consumed for a larger area. However, the lifetime of liquid foams does not usually exceed a few hours. Therefore, to overcome this limitation and create highly stable foams, causes of their death were studied. The first one considered is coalescence. It gives rise to the rupture of films surrounding bubbles. The phenomenon of coarsening was observed too: this is caused by a gas transfer from a high internal pressured bubble to a lower one. Drainage was regarded as well. It corresponds to the downward flow of the liquid soap constituting the films on account of gravity. Finally, the utilization of magnetic particles and a magnetic field were noticed as a research topic which could lead to interesting results. In fact, an opposite force to the gravity is created, thus the flow decelerates: consequently drainage is countered. The quantification of the influence of a magnetic field on this phenomenon as a function of its magnitude has particularly been envisaged. The study especially aimed to discern the best conditions to obtain steady ferrofluid foams because of their multiple advantages: they have many interesting specific properties, for instance drainage can be easily controlled and eventually the ferrofluid can be saved thanks to magnetic fields.

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