Title:

Formation of periodic patterns during coalescence of reactive sessile droplets.

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Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

The coalescence behaviour of sessile drops of completely miscible liquids can be affected by a Marangoni flow, resulting from the surface tension difference of the two liquids. For non-reactive liquids this has been analysed in detail meanwhile [1], [2] and [3]. However, for drops containing reactive liquids the coalescence behaviour is still poorly understood. Besides from being an interesting topic in fundamental science, the coalescence behaviour of reactive droplets is very important in a wide range industrial applications including nuclear fuel recovery[4].

We study the coalescence behaviour of sessile drops containing aqueous solutions of cerium nitrate and oxalic acid. Upon contact, these compounds form insoluble, colour-less cerium oxalate. We find that in a certain range of component concentrations and surface tension differences between both liquids, the precipitating cerium oxalate forms amazing periodic patterns of fringes with different light-scattering properties (Figure 1). The local morphologies and structures of the precipitates are characterized by SEM, XRD, and confocal microscopy. The relation between the various control parameters (initial contact angles, reactant concentrations, surface tension difference), the stripe morphology (spacing of the fringes), and the Marangoni flow is analysed by optical microscopy and image processing. Currently, our analysis focuses on the pattern formation as a result from a feedback between precipitation and material transport by Marangoni flow.

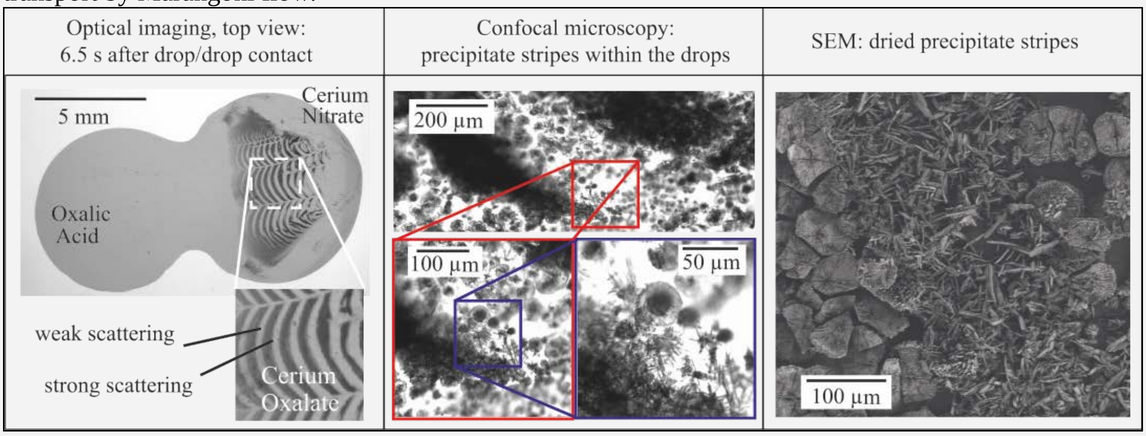

Figure 1: a) Periodic patterns appearing during drop coalescence (optical imaging via top view camera). Precipitate morphologies of two fringes inspected by confocal microscopy (b) and (after drying) by scanning electron microscopy (c).

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[2] S. Karpitschka and H. Riegler, Phys. Rev. Lett., 109, 2012, 066103.
[3] S. Karpitschka and H. Riegler, Langmuir, 26, 2010, 11823-11829.
[4] S. Charton et al., Chem. Eng. Res. Des., 91, 2013, 660-669.