(Invited) Simplicity in complexity – towards a soft matter physics of caramel

W Poon

University of Edinburgh, UK

Caramel is a mixture of sugars, milk proteins, fat and water cooked at high temperatures to initiate Maillard reactions. We study caramels as 'active emulsion-filled protein gels', in which fat droplets are chemically-bonded to a background gel matrix of cross-linked proteins in a concentrated aqueous sugar solution. We delimit a 'caramel region' in composition space. Oscillatory rheology within this region reveals that we can superpose the mechanical spectra of our caramels onto a set of master curves using time–composition superposition (tCS) over 12 decades of frequency, so that these caramels are instances of an underlying 'universal material'. This insight constrains the molecular mechanisms for structure formation, and implies that measuring a couple of parameters will suffice to predict the rheology of our caramels over 12 orders of magnitude in frequency.