MS42-03 | Morphology and Structure of Metal-Organic Framework ZIF-8 during Crystallisation Measured by a New Technique: Dynamic Angle Resolved Second-Harmonic Scattering (AD-SHS)

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Morphology and structure of a metal-organic framework measured during crystallization measured by a new technique: Dynamic Angle Resolved Second-Harmonic Scattering (AD-SHS).

Crystallization is often much more complex than a classical nucleation and growth process, involving intermediates, metastable phases, etc. Second-order nonlinear optical techniques might be particularly interesting in investigating these early stages as they are inherently sensitive to the way matter is organized. Indeed, recent developments in these techniques have opened a window into morphological and structural characteristics for a variety of supramolecular systems [1]. To interrogate the structure of a species in solution, second-harmonic scattering (SHS) can be used, yet to study the dynamics of the early stages of crystallization, the measurement technique is too slow. We developed a new measurement scheme where the dependence of SHS on the polarization of light and on the scattering angle is measured in a time resolved manner. Fast acquisition times are achieved through Fourier imaging. The angular dependence provides morphological insight including shape and size, while the polarization provides structural insight related to point group symmetry. We applied the technique to the crystallization of the metal-organic framework ZIF-8 [2]. Our findings highlight the potential of dynamic angle-resolved harmonic light scattering to probe crystal growth processes, assembly–disassembly of biological systems, adsorption, transport through membranes and myriad other applications.

[1] S. Van Cleuvenbergen et al. Angew. Chem. Int. Ed. 56, 9546–9550 (2017); P. D. Schmitt et al. Anal. Chem. 88, 5760–5768 (2016); A. Ferguson et al. Nat. Chem. 8, 250–257 (2016).
[2] S. Van Cleuvenbergen et al. Nat. Commun. 9, 3418 (2018).