

Liquid Chemistry Dynamics with Electron Microscopy (EM): Nano-Catalysis Mechanisms by Processing EM Images and Videos with Machine Intelligence

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Imaging chemical reactions with electron microscopy is now recognized as a fascinating tool for studying processes in the liquid phase [1]. Indeed, the vast majority of organic synthesis and catalysis reactions occur in the liquid state and ubiquitously contribute to such vital areas as drugs development, medicine, pharmaceuticals, new smart materials, and agrochemicals, among many others. Recently, the involvement of a dynamic "cocktail"-type catalysis was experimentally evidenced, and video movies of nano-particles dissolution were recorded with EM (Figure 1) [2]. EM in the liquid cells can advance nano-scale understanding not only to catalysts and reagents but also to a process of restructuring of reaction media [3].

Recording EM video on a highly dynamic liquid system gives ~40 000 individual frames (images) during 30 min even on standard routine hardware [4]. EM video-monitoring of chemical reactions over a very reasonable time period opens a possibility of big data collection, which can be further analyzed with machine intelligence (MI) [4]. The perspectives of EM/MI data processing for the development of new chemical and catalytic systems will be presented and discussed [5].

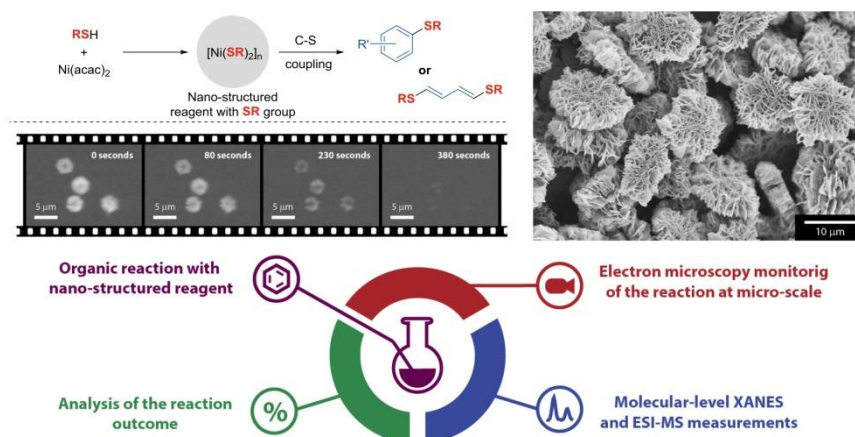


Figure 1. A dynamic catalytic system with nanostructured reagents studied by liquid cell EM [2].

References:

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