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Growth kinetics of metal nanoparticles on solid surfaces

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Dispersed metal nanoparticles (nps) in a polymer matrix are essential for many technological applications, including biological imaging, thin film technology, magnetic recording media, optoelectronics and sensors. Real time investigation of the evolution of nps size and shape during the in-situ metal deposition on polymer thin films enables a fine tune of magnetic and electric properties. Metals in their atomic state are deposited on several homopolymer and block copolymer films by DC magnetron system (Metwalli et al., 2013, Metwalli et al., 2008, Buffet et al., 2011). With the unprecedented time resolution of 10 milliseconds, the growth kinetics of the metal nps on the polymer surfaces is monitored using in-situ GISAXS. An exponential growth of nps size on all polymer surfaces is observed. Below a certain critical nps size, an initial fast particle growth is due to high particle mobility. A slower kinetics at concentrated metal dispersion is due to the strong metal-metal interactions. The metal growth kinetics study for many chemically different homopolymer films explains the long-time debated high selectivity characteristics of metals towards one block in block copolymer based nano-templates.

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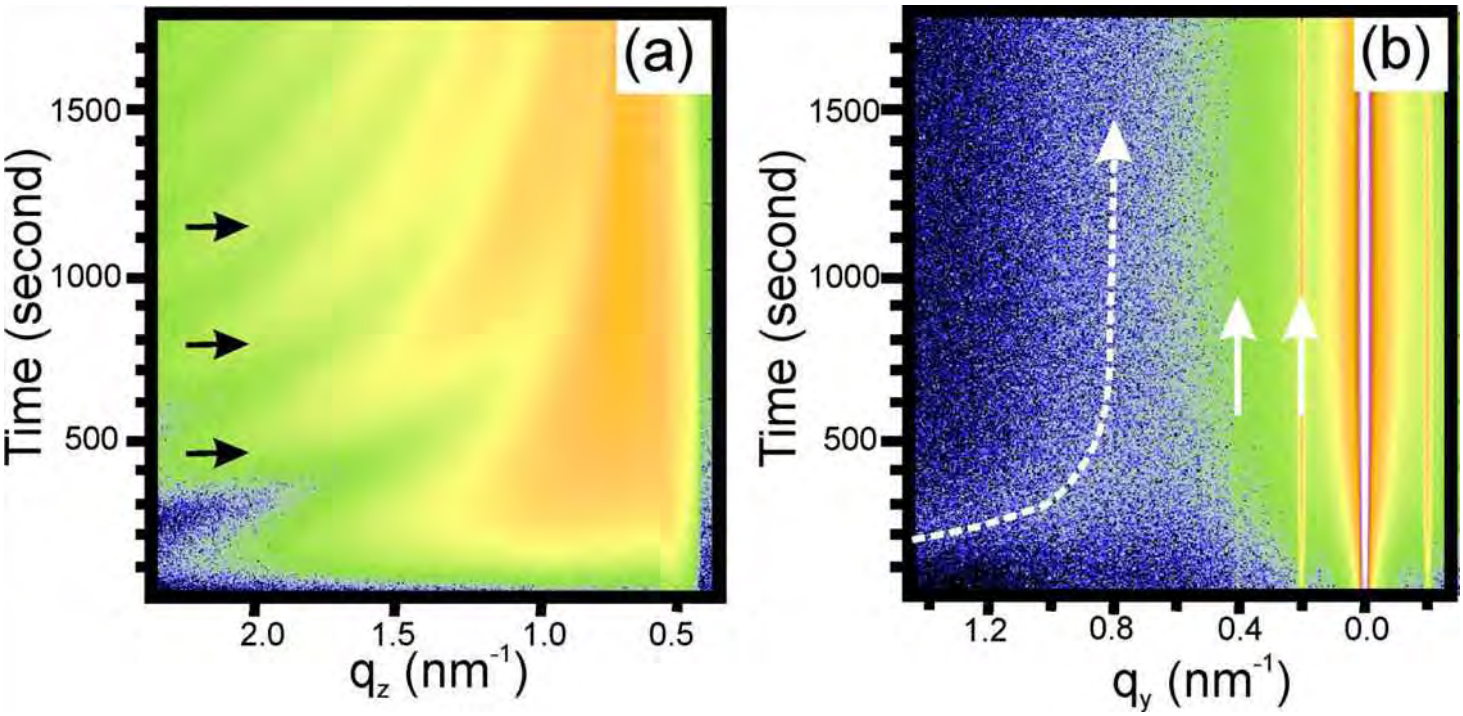

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