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Crystallization of Polyethylene on nucleating and on passive substrates

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— Since the late 1950's it has been known that polymers are able to crystallize epitaxially on suitable crystalline substrates. Whereas epitaxial crystallization experiments have been typically performed from solution, we here present a study of the morphology of thin films of polyethylene crystallized from the melt on a number of substrates with different ability to invoke crystallization, namely mica, NaCl, SiO_2 and HOPG. Using intermittent-contact mode AFM very different structures are observed on the surface of the polymer film depending on the kind of substrate as well as film thickness. For very thin films ($\sim$ 30 nm) on NaCl and HOPG edge on lamellae, oriented in domains according to the underlying crystal lattice, show up while for mica and SiO_2 flat-on lamellae dominate. With increasing film thickness (up to 130 nm) the orientation of the lamellae on HOPG and NaCl becomes weaker, while on mica and SiO_2 a spherulitic morphology develops, which is not present in the case of HOPG and NaCl.

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