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Factors that control the morphology of ice films on metal surfaces[1]

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Examination of the equilibrium nanoscale morphology of ice films provides important clues about the energetics of water-metal interactions [1]. In this talk I compare STM and DFT results for the structure of ice films on Pt(111) and Ni(111). Because the lattice constants of Ni and Pt differ by 10%, this comparison allows us to probe the effect of lattice misfit on ice nucleation and growth. On both substrates, STM suggests a first molecular water layer very different from bulk ice: besides the usual hexagonal rings they also both contain a motif of pentagons and heptagons [2]. Furthermore, at 140K, thicker films on both substrates dewet the substrate to lower interfacial energy by forming 3-dimensional ice crystallites several nanometers thick [3]. However, despite these similarities, there are striking differences in the submonolayer structure and in the kinetics of the dewetting process. Using DFT calculations as a guide, I will discuss the how these differences can be related to substrate lattice constant and draw conclusions about the processes that control ice film morphology.

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