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Modeling the formation of nanoscale pores in metal oxides during anodization CHRISTINE SAMPLE, ALEXANDER GOLOVIN, Northwestern University — A theory of the formation of nanoporous metal oxides grown by anodization is developed. Linear stability analysis of an oxide layer is performed for the case of field-dependent conductivity, and parameter regions are determined corresponding to the onset of instability and the growth of pores. It is shown that competition between the destabilizing effect of field-assisted dissolution and the stabilizing effect of surface energy provides the selection mechanism of the pore diameter. The weakly nonlinear evolution of the oxide layer is shown to be governed by the Kuramoto-Sivashinsky equation whose solutions exhibit spatio-temporal chaos. A system of strongly nonlinear long-wave equations describing the evolution far from the instability threshold is described. It's numerical solution illustrates the formation of deep pores.

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