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Whisker Growth and Cavity Formation at the Microscale

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Abstract. We discuss a recent progress in research on micro-/nanoscale metal and oxide whiskers. It is common to define whiskers as quasi-one-dimensional (elongated) solid objects that formed on a surface of a crystalline material by growth from its base. Whisker growth is often accompanied by formation of cavities and cracks in the bulk of material. This fact did facilitate the advancing of various explanations on the mass transfer for whisker growth. First theoretical models of metal whiskers growth were based on the theory of crystal lattice defects and on the assumption of inherent mechanical stresses in the material that "push" the whisker out. However, those models were not applicable to all variety of whisker growth observed. There are more complex cases of whiskers, such as oxide whiskers that formed in chemical reactions, such as oxidation during annealing in air or a synthetic reaction in a liquid. Theoretical modelling of the complex cases is still a challenging task at the border of chemical kinetics and materials science. Oxide whiskers are usually considered separately from metal whiskers, thus the fundamental interlink between the two cases might be lost. The goal of the present review is to collect the most prominent observations and theoretical explanations of whisker growth for both single phase and compound objects into a single document.

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