DESCRIPTION FOR THE GENERAL PUBLIC

Passive layers form on many metal surfaces e. g. iron, aluminum, chromium and others. They protect the metal against corrosion blocking an access of oxygen, water and other environment components to the “bare” metal surface. They fulfill this function rather efficiently and , paradoxically, even better in a more aggressive environment. This feature is in a direct relation with the electrical properties of electrode-solution interfaces when the metal electrode put in contact with electrolyte solution forms a part of an electrochemical cell. The coverage with passive layer and the morphology of the surface depend on electrical condition of the cell. In the potential range where the passive layer forms, we may observe formally negative resistance. Such systems behave like amplifiers. They can be unstable and switch their state between two stable states. Similar to amplifiers in concert halls they can undergo excitation and their potential oscillates in galvanostatic conditions. This is similar to unpleasant high pitch sound that often arises due to loudspeaker - microphone interaction via a high yield amplifier. In this project we want to understand how these oscillations couple with the morphology of the surface. Can they form regular patterns characteristic for standing waves? In the case of acoustic waves the standing wave arises between the loudspeaker and the microphone. We assume that applying potential oscillations to the system we can regulate the morphology of the surface and obtain patterns useful for obtaining nanostructured materials. This hypothesis is very difficult to verify in real world experiments. The experiments can be very costly, especially without a prior guidance on the possible condition when the expected patterns may emerge. In this project we resort to computer simulated experiments that can give indications on whether and in what conditions we can expect interesting structures. The elaborated numerical model and computer simulations can direct the experimental work in the case of a positive result. They will clarify at least whether and under what conditions we can use passive layers for unconventional computing as an interface for information transfer from electric signal to chemical or morphological form.