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Unusual synchronization behaviors during the electropolishing of silicon wafers: experiments and theory

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The electrodissolution of silicon wafers exhibits a variety of oscillatory spatio-temporal patterns. Most typically, rather peculiar cluster patterns emerge, which always exhibit a pronounced oscillation of the uniform mode. In addition, the spontaneous formation of synchronously and incoherently oscillating domains, i.e., a chimera-type state, is observed. I will first give an overview of the experimentally observed oscillatory states with emphasis on their synchronization behavior and then discuss the current theoretical understanding of their emergence. In particular, I will show that the patterns can be well reproduced with a modified complex Ginzburg-Landau equation with nonlinear global (amplitude) coupling. To elucidate the role of the nonlinear global coupling, the dynamics of an ensemble of identical nonlinearly coupled Stuart-Landau oscillators is also discussed.