Diffusional dependent structures on the crystal surface

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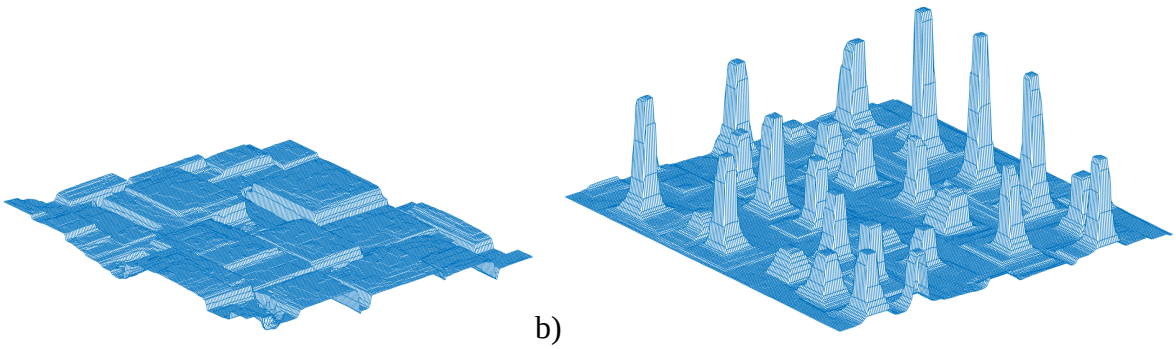
Different patterns can be created on the surface of growing crystals, among which the step bunches and/or step meanders are two of the most studied. The Ehrlich–Schwoebel effect at the surface steps is considered one of the "usual suspects" of such patterning. The combination of a direct and inverse step barrier and the proper selection of the potential of the well between them or changing the height of the direct step barrier leads to the growth of nanocolumns, nanowires, and nanopyramids or meanders, in the same system [1]. Based on our (2 + 1)D vicinal Cellular Automaton model [2,3] we show that not only the combination of step barriers is crucial in the formation of surface structures. In particular, we show that changes only in the diffusion process can lead to different patterns (Fig).



a) b)

Fig. Structures obtained for initial concentration of particles c_0=0.02, Inverse Ehrlich-Schwoebel barrier with jump probability given by P_{ies}=0.2, direct Ehrlich-Schwoebel barrier with jump probability given by P_{des}=0.4, the energy of particle that stays at the bottom of the step p_w=2.5, length of terrace l_0=2 and a) number of diffusional steps n_{DS}=10 which leads to nanopillars b) n_{DS}=40 which leads to nanowires. System size 200 x 200.

[1] M. Załuska-Kotur, H. Popova and V. Tonchev, *Crystals* **11**, 1135 (2021).
[2] A. Krasteva, H. Popova, F. Krzyżewski, M. Załuska-Kotur, M. and V Tonchev, *AIP Conf. Proc.* **1722**, 220014 (2016).
[3] F. Krzyżewski, M.A. Załuska-Kotur, A. Krasteva, H. Popova, and V Tonchev, *J. Cryst. Growth* **474**, 135 (2017).