Some generalized models of random sequential adsorption of linear *k*-mers on a square lattice: jamming and percolation

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The review is devoted to our recent findings regarding the percolation and jamming of the linear *k*-mers (particles occupying *k* adjacent sites) on a square lattice [1–5].

Deposition of large particles such as colloids, polymers or nanotubes on substrates can be considered and studied as the random sequential adsorption (RSA). In ideal RSA model, objects randomly deposit on a substrate; this process is irreversible, and the newly placed objects cannot overlap or pass through the previously deposited ones. The adsorbed objects may be identical or present a mixture of objects of different sizes and shapes. With a large enough concentration of the deposited objects, they can form a spanning path between the opposite sides of the substrate and this concentration corresponds to the percolation threshold. If the deposition of the objects goes infinitely long, a jamming state is reached. At the jamming state, there are still voids between the previously placed object on the substrate, but their size and shape are not sufficient to deposit even one additional object.

Great efforts have been devoted to studies regarding percolation and jamming for the RSA deposition of elongated particles, particularly linear *k*-mers.

Very often, the real surfaces are chemically heterogeneous and contain defects; moreover, the substrates may be prepatterned. The structure of the elongated particles, e.g., carbon nanotubes, adsorbed on the substrate may also be highly heterogeneous, e.g. due to their chemical functionalization. Different variants of the more general RSA models, taking account of the heterogeneity of substrates, interactions between the deposited particles and the possibility of surface diffusion have been proposed. These models are more realistic in their description of the experimental results for colloid particle adsorption on substrates characterized by a wide spectrum of binding energies. The jamming and percolation of *k*-mers on disordered (or heterogeneous) substrates with defects, or *k*-mers with defects, have also attracted great attention. Moreover, anisotropy can be introduced by postulating unequal probabilities for deposition of elongated objects along different directions.

In more general RSA model the anisotropy of deposition can reflect the influence of the external fields, flows or anisotropy of the substrate. The adsorption of the elongated particles in the presence of the external fields produces the anisotropic layers. Another generalized RSA model of cooperative sequential adsorption accounts of the presence of very strong near-neighbor (NN) lateral repulsive interactions and dependence of the adsorption probabilities on the local environment. In the simplest case, the constraint assumes that all NN locations are empty. For this model the percolation is observed only at some interval $k_{min} \le k \le k_{max}$, where the values k_{min} and k_{max} depend upon the fraction of forbidden contacts *d*.

For ideal RSA and completely disordered system, a conjecture has been offered that percolation is impossible when *k* exceeds approximately 10^4.

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