Materials for the future

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Graphene and 2D materials, despite being relatively fresh materials, have already taken a firm place in research, development and applications. A number of exciting phenomena have been discovered in these crystals and they continue bringing exciting results on a regular basis. However, probably the most important characteristic about 2D materials is that they offer a possibility to form on-demand van der Waals heterostructures, where individual 2D crystals are stacked together, forming a novel, 3D structure, which composition (and thus, their properties) can be controlled with atomic precision. This have opened a new directions of research: materials on demand. The properties of the resulting heterostructure can be designed with very high precision. The space of parameters is so large that the use of machine learning methods becomes essential.

So, what is next for materials science after the dream of “materials on demand” has been realised? One of the dreams are materials which have some characteristics of biological systems: those with self-healing capabilities, with memory functions, those which can evolve differently depending on external conditions. I will be discussing the methodologies to design such artificial living systems and the areas of their applications.