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Tailoring of surface properties by means of nanoparticles

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Surface roughness is one of key parameters influencing interaction of solid surfaces with their surrounding environment. Typical example, where roughness plays a crucial role, is wettability of surfaces, i.e. property important in diverse technological applications. As a consequence, various methods were developed for production of surfaces with required roughness on nanometric scale.
In this contribution we present novel approach suitable for the fabrication of coatings with well-defined roughness and wetting behaviour, which is based on utilization of gas aggregation sources of nanoparticles. This method combines two consecutive steps:
(i) deposition of film of nanoclusters or nanoparticles on a smooth substrate
(ii) overcoating such prepared films by a thin layer of metal or plasma polymer.
It is shown that this technique allows controlling independently the surface roughness (by size and number of nanoparticles) and surface chemistry (by chemical composition of the overcoat film). The possibility to use this approach for tailoring wetting properties of surfaces in wide range is demonstrated on examples of films of plasma polymerized hydrocarbon nanoparticles overcoated with thin films of plasma sputtered titanium, PTFE or nylon, selected as examples of materials having either hydrophobic or hydrophilic character when deposited as smooth films. It is shown that achievable root-mean-square roughness by this method covers the range from about 1 nm to more than 100 nm. This, in turn has an impact on wettability of deposited coatings that spans from super-hydrophilic to super-hydrophobic.
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