Multilayered omniphobic coating on stainless steel based on aerosol nanoparticle synthesis

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Multilayered omniphobic coating on stainless steel based on aerosol nanoparticle synthesis

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Introduction & the experimental process

Omniphobic coatings have plenty of potential in various applications, and have raised a lot of interest during the last decade. However, no really good solutions have so far been developed for producing a mechanically stable coating with strong omniphobicity. Also, resilient and hard substrate materials present challenges for the fabrication. A new combination of coating methods, producing a layered nanostructure according to Figure 1, has been studied in order to discover better solutions for fabricating omniphobic coatings on stainless steel surface.

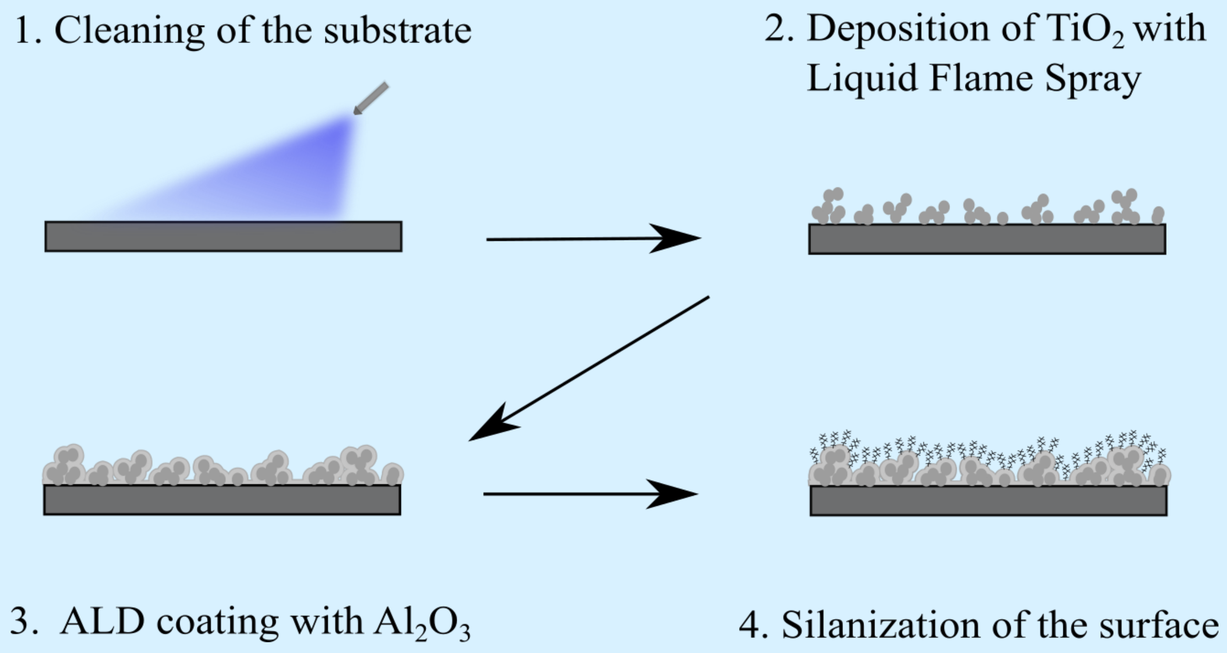

Figure 1. A schematic representation of the coating fabrication process.

The LFS-generated nanoparticles (experimental setup presented in Figure 2) produce the necessary surface roughness for effective liquid repellency. The ALD layer enhances the cohesion between the particles and their adhesion to the substrate. Silanization of the prepared double layer lowers the surface energy, thus promoting its omniphobicity.

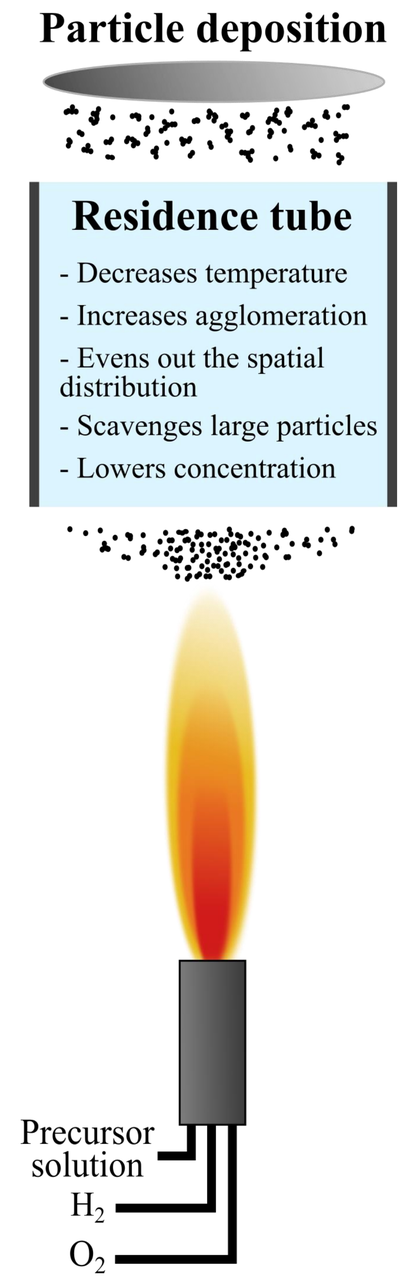

Figure 2. The experimental setup for LFS nanoparticle synthesis.

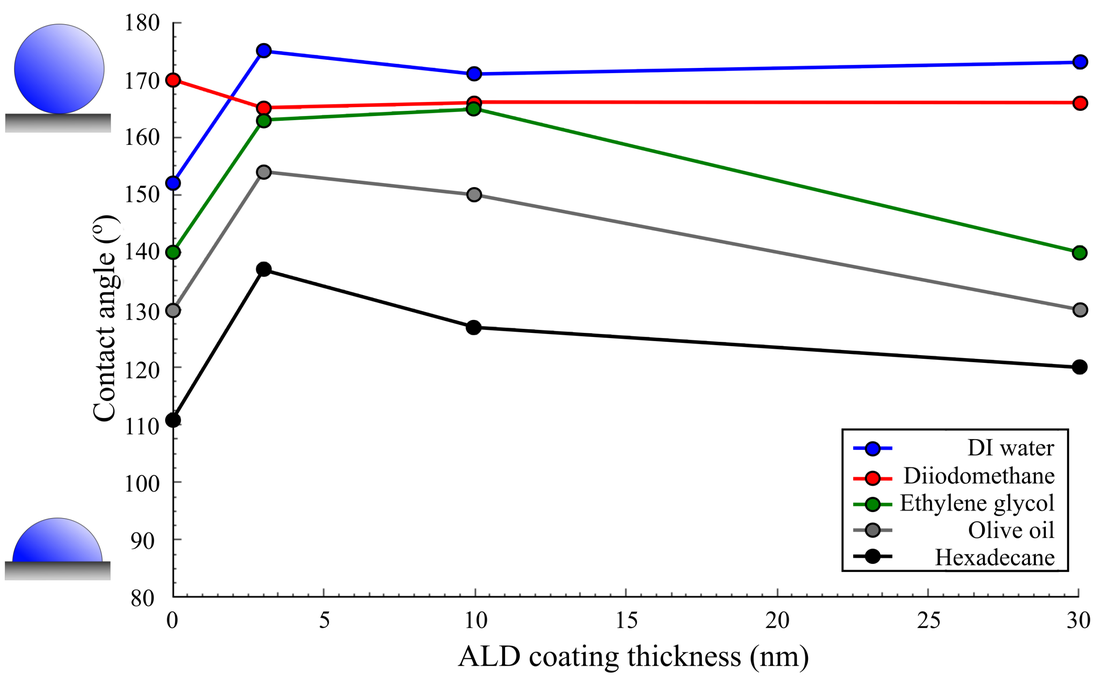

Figure 3. The contact angle for different test liquids as a function of ALD layer thickness.

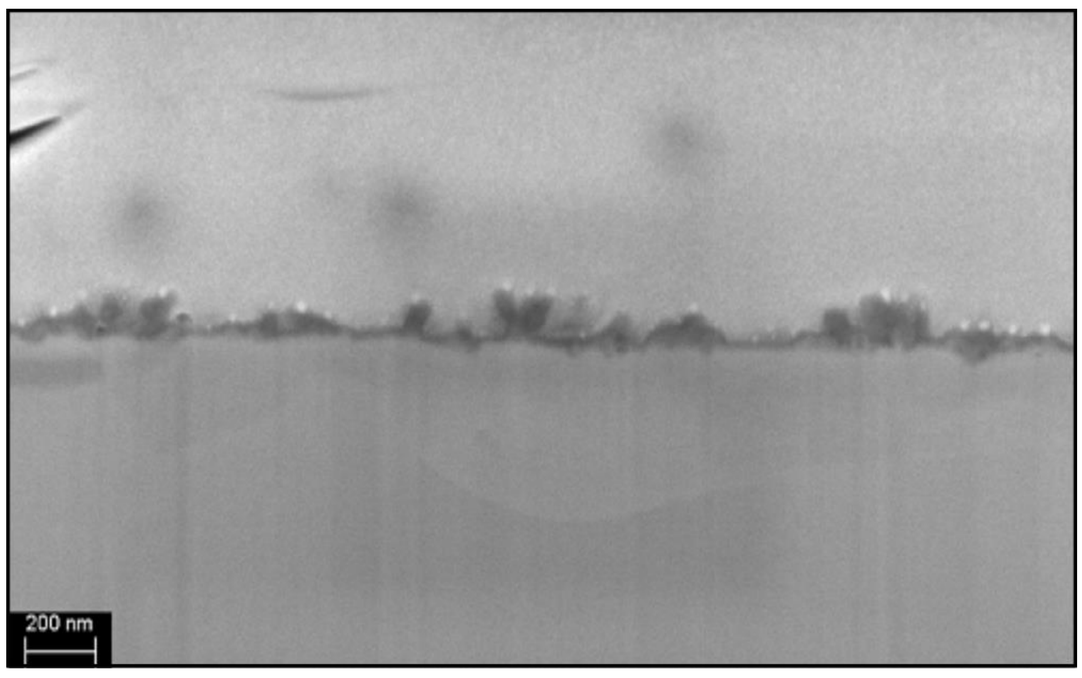

Figure 4. A cross-sectional SEM image of the coating.

Conclusion

- A combination of LFS, ALD and silanization can be used to produce a very thin and effective omniphobic coating.
- The addition of the residence tube after the flame helps produce a spatially even nanoparticle layer.
- The ratio of the repellency to the mechanical stability can be adjusted by varying the thickness of the ALD layer.

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