

# Hybrid Materials from Sculptured Thin Films and Applications

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Coherently ordered nanostructures establish a new class of surfaces, created by a regular arrangement of congruent, three-dimensional-shaped nanostructures. Shape, size, and relative position of the nanostructures allow nearly limitless combinations. Size and relative position can be varied from nanometer to micrometer regions. This presentation focusses on the extremely anisotropic optical properties of highly-ordered three-dimensional nanotopographies known as sculptured columnar thin films (SCTFs). We discuss tailored deposition of single and heterostructure [1] SCTFs and core-shell structures [2,3] using ion-beam and electron-beam assisted glancing angle and plasma-assisted atomic layer deposition techniques from a large variety of materials [1-5]. We will show and discuss how these materials have enabled the creation of new sensing and separation techniques for molecular interactions at the surfaces and interfaces [3], the invention of anisotropy contrast optical microscopy and imaging chromatography [4]. We will demonstrate exemplary applications to imaging molecular interactions and living cells [5], and fluidic separations at the nanoscales [4].

## References

- [1] D. Sekora et al., Appl. Surf. Sci. online (2016) doi.org/10.1016/j.apsusc.2016.10.104.
- [2] A. Mock et al., Appl. Phys. Lett. 108, 051905 (2016).
- [3] P. Wilson et al., RSC Advances 6, 63235-63240 (2016).
- [4] D. Peev et al., Rev. Sci. Instr. 87, 113701 (2016).
- [5] T. Kasputis et al., Acta biomaterialia 18, 88-99 (2015).

## Figures

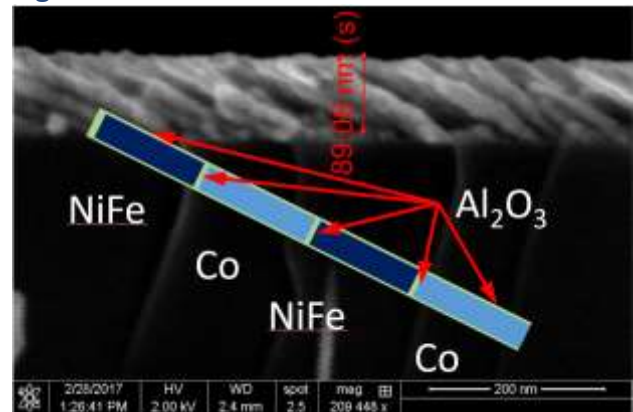


Figure 1. Slanted Columnar Heterostructure Thin Film (SCHTF) with 1dimensional junctions for tailored magnetism [1].

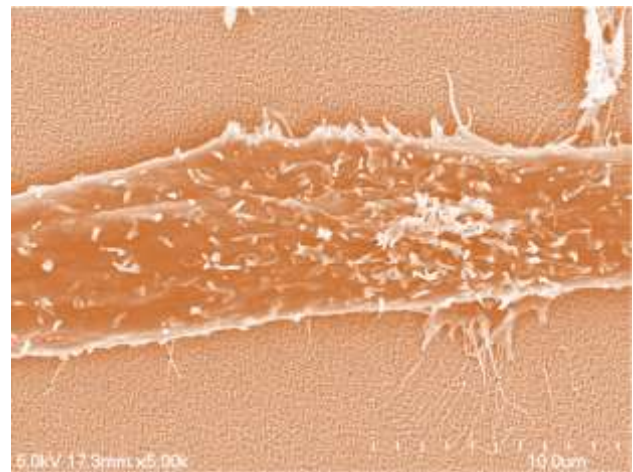


Figure 2. Stimulated cell-substrate interactions of NIH/3T3 mouse fibroblasts on titanium STFs. [5]

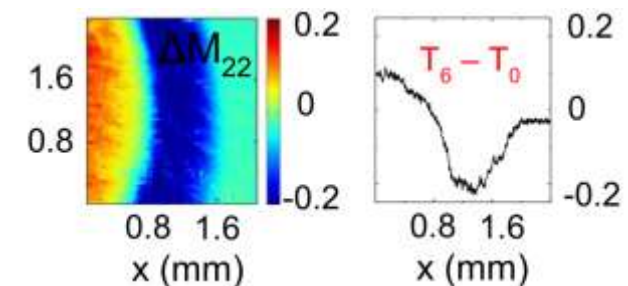


Figure 3. Anisotropy contrast of chromatographic separation of lipophylic dyes within SiO<sub>2</sub>-SCTF [4].