# Tvarkių Ag nanokubų masyvų formavimas ir tyrimas

# Formation and Investigation of Regular Ag Nanocube Arrays

Mindaugas Juodėnas[1], Tomas Tamulevičius[1], Svajūnas Korsakas[1], Joel Henzie[2], Sigitas Tamulevičius[1]
[1]Institute of Materials Science of Kaunas University of Technology, K. Baršausko St. 59, LT-51423 Kaunas, Lithuania
[2]International Center for Materials Nanoarchitectonics, National Institute for Materials Science, 1-1 Namiki, Ibaraki 305-0044, Tsukuba, Japan
mindaugas.juodenas@ktu.lt

A high-throughput, high-yield formation of well-ordered nanoparticle arrays is still an intensively researched topic. One way of achieving high spatial reproducibility and regularity of nanostructures is by using deposition on pre-structured templates [1]. One of the most prominent techniques to deposit nanoparticles on such substrates is capillary force assisted assembly (CAPA) [2]. Specifically engineered nanoparticles can exhibit properties useful in photonic, biomedical and energy applications [3]. Briefly, CAPA process can be described as a combined evaporation induced flux and capillary force confinement effect that produces conditions where nanoparticles can be trapped into predefined positions, even controlling their orientation (Figure 1).

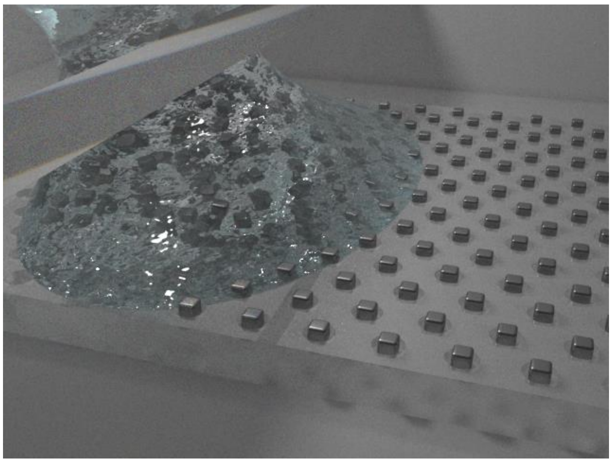

Figure 1. Graphical representation of the CAPA process (not to scale)

Here we present our most recent achievements in nanoparticle deposition research area. Dynamics of the assembly yield was investigated, specifically during the beginning of a deposition. Recently we investigated this process using fluorescent 270 nm sized polystyrene beads and image analysis and found its dependencies on process parameters, i.e. substrate translation velocity and temperature [4]. We demonstrate that the same tendencies obeyed when silver nanocubes were deposited into hexagonally arranged pits on a PDMS template. During the deposition, various transitional states of the assembly yield development could be achieved, leading to a change of the concentration of nanocubes in the accumulation region near the assembly zone therefore influencing the number of particles per trap. Resulting nearly 100% deposition yield assemblies (at least 1 particle per trap) demonstrated different colors of scattered light in the dark field microscopy images. SEM inspection and optical spectroscopy measurements were performed. Number of particles per trap as well as particle to particle spacing had a direct influence on the scattered light properties. Therefore, the optical response of different nanocube configurations were modeled employing the Finite Element Method (FEM) (Figure 2). Experimental and modeling results showed good correlation as well as an applicable representation of the assembly yield transition investigation and plausible applications for structural coloring.

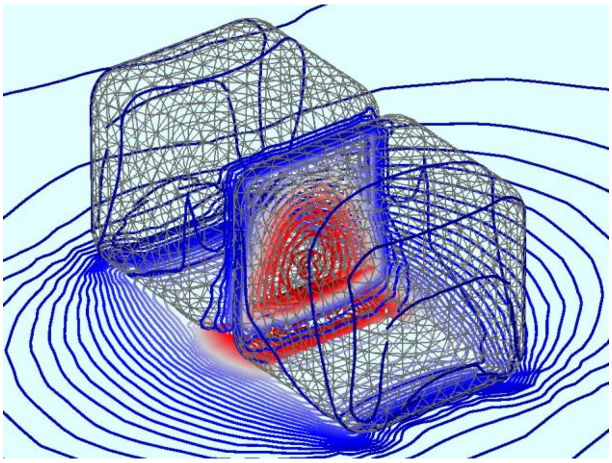

Figure 2. FEM model of 4 nm spaced 80 nm edge length Ag nanocubes. Gray mesh represents the nanocube geometry and the contour plot represents the time average of scattered EM energy density

*Keywords: CAPA, nanocubes, plasmonics*

## References

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