

Extended domains of organized nanorings of silver grains as surface-enhanced Raman scattering sensors for molecular detection

M Bechelany *et al* 2009 *Nanotechnology* **20** 455302 (8pp) doi: [10.1088/0957-4484/20/45/455302](https://doi.org/10.1088/0957-4484/20/45/455302)

[M Bechelany](#), [P Brodard](#), [L Philippe](#) and [J Michler](#)

Laboratory for Mechanics of Materials and Nanostructures, EMPA, Swiss Federal Laboratories for Materials Testing and Research, Feuerwerkerstrasse 39, CH-3602 Thun, Switzerland

E-mail: mikhael.bechelany@empa.ch and pierre.brodard@empa.ch

Abstract. The possibility to synthesize large areas of silver grains organized in nanorings using a simple technique based on nanosphere lithography and electroless plating as a metal deposition method is described for the first time. In addition, we present a systematic SERS study of the obtained long-range ordered silver nanodots and nanorings. The possibility to precisely control the size, the interdistance and the morphology of these nanostructures allows us to systematically investigate the influence of these parameters on SERS. We show that the best possible SERS substrates should not only present optimal sizes, interdistances and shapes, but also a grain-like structure composed of sub-100 nm grains in order to maximize the number of hot-spots. In addition, we show that grains arranged in nanorings present higher enhancement factors ($E_F = 5.5 \times 10^5$) as compared to similar arrays made of nanodots. A wide range of applications, including real-time monitoring of catalytic surface reactions, environmental and security monitoring as well as clinical and pharmaceutical screening, can be envisaged for these SERS substrates.

Print publication: Issue 45 (11 November 2009)

Received 28 July 2009, in final form 17 September 2009

Published 16 October 2009