

Takao Fukuoka¹

Tomomi Fujii¹, Mihoshi Yamagaki¹, Toshiya Yasunaga², Akinobu Yamaguchi³, Tom Hahimoto^{1,4}

¹Archilys Corp., Kyoto, Japan; ²Aichi Gakuin University, Nagoya, Japan; ³Toyo University, Kawagoe, Japan; ⁴Vilnius University, Vilnius, Lithuania

Info2100@archilys.com

SERS Detection of Plasmonic Nanotags on Kyoto High-end Silk Crafts

Abstract

Surface-enhanced Raman scattering (SERS) is a powerful analytical technique for high-sensitivity detection. Recently, SERS-active plasmonic nanotags[1] have attracted attention as a new means of product authentication. In this study, we investigated their application to Kyo-Kanoko Shibori, a high-end traditional silk textile from Kyoto characterized by spotted tie-dyed patterns resembling the back of a young fawn. Gold nanoparticle-based nanotags containing a Raman reporter molecule were deposited with hydrophilic polymer to give a total volume of 5, 10, 15, or 20 μL per spot and was then allowed to dry. Red, purple, pink, and gray textiles were evaluated for changes in appearance and texture. SERS measurements were performed at three positions within each deposit using a portable miniRaman Standard/SERS instrument (Lightnovo, Birkerød, Denmark) and a Raman microscope (Lambda Vision, Sagami-hara, Japan). A one-second acquisition under defocused laser excitation was sufficient to obtain the characteristic SERS spectrum of the deposited nanotags. A deposit volume of 5 μL was sufficient for SERS detection, while the appearance and texture of the textiles were largely preserved even at a deposit volume of 20 μL . SERS detection was also affected by textile topography and dye color. These results demonstrate that SERS-active plasmonic nanotags can be used for unobtrusive authentication of silk textiles when the polymer formulation, deposit volume, and measurement. This research was supported by the Innovative Science and Technology Initiative Security, ALTA, Japan (Grant Number JPJ004596).

References

- [1] T. Fukuoka et al., *Sci. Rep.*, 12 (2022) 985.

Figures



Figure 1: SERS based authentication with invisible plasmonic nanotag deposited on silk textile.