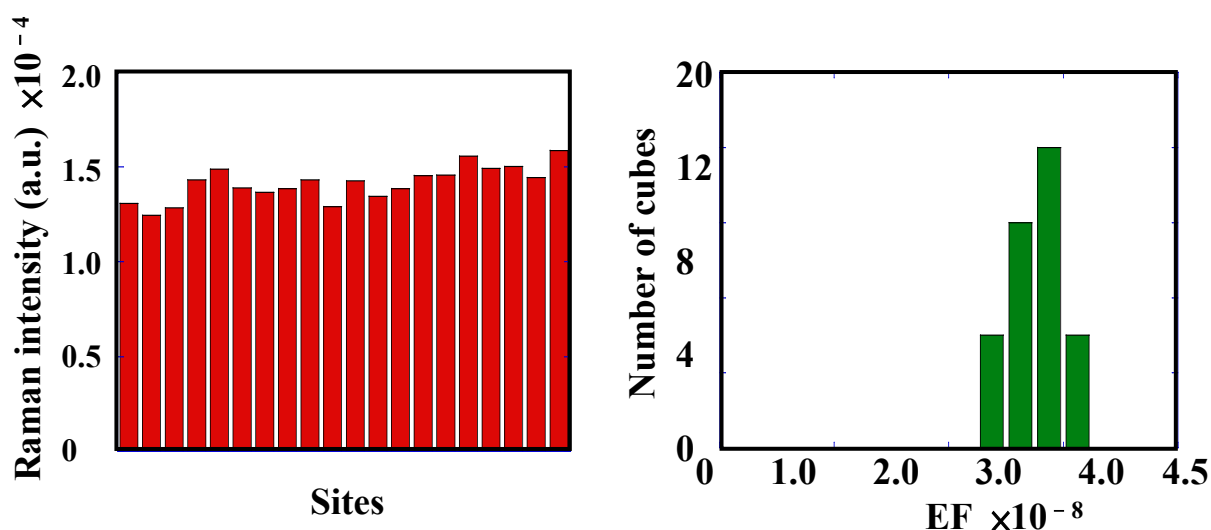


Supplementary Information II



The SERS measurements were taken from 20 different sites of substrates in the presence of 633 nm laser excitation in an area of $1 \times 2 \text{ cm}^2$. The EFs from FDTD method are calculated according to the following equation 1³²:

$$\text{Enhancement Factor}(EF) = \int \frac{EM \text{ of substrate}^4}{EM \text{ of background}^4} \dots(1)$$

The EFs from SERS measurements are calculated according to the following equation 2³³:

$$\text{Analytical Enhancement Factor}(AEF) = \frac{I_{SERS}/C_{SERS}}{I_{RS}/C_{RS}} \dots(2)$$

where I_{SERS} and I_{RS} are the Raman intensity of R6G on SERS substrate and on a microscope slide, respectively. C_{SERS} and C_{RS} are the concentrations of R6G on SERS substrate and on a microscope slide, respectively.

Student-t distribution with 95 % confidence interval from peak 1360 nm was used to determine the AEF. The following equation 3 was used to calculate the 100 (1- α) % confidence interval (CI).

$$\bar{X} \pm t_{\alpha/2} S / \sqrt{n} \dots\dots (3)$$

Where the \bar{X} is the mean of the samples; the value of $t_{\alpha/2}$ is 1.729 under the condition with 19 degree of freedom and 95% CI according to the table of t distribution; n is the numbers of samples; and S is the standard deviation, that is 1.93×10^7 for NcIM and 1.28×10^3 for NsIM. The analytical EF of NcIM caculated is $(3.08 \pm 0.07) \times 10^8$ while that of NsIM is $(1.52 \pm 0.05) \times 10^3$.