A Nanoscanning Platform for Biological Assays

S. Kim, S. Gouda, S.-G. Kim (P. So group)
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An in-plane nanoscanning platform with switchable stiffness being developed at the Micro & Nano Systems Laboratory (MNSL) [1] can be an alternative to the existing atomic force microscope (AFM) system. The nanoscanning platform has a carbon nanotube (CNT) tip, which is known as one of the ideal candidates for AFM tips because of their superior mechanical and chemical properties. Raman Spectroscopy has gained a lot of interest as a tool for single molecule detection since it has easy and fast sample preparation and measurement compared to the existing technologies, such as X-ray crystallography and nuclear magnetic resonance. Among the several approaches attempted in order to enhance the weak Raman signals is tip enhanced raman spectroscopy (TERS). The enhancement of the electric field due to the plasmon resonance on the coated metal surface was predicted qualitatively [2]. The metal-coated CNT or CNT filled with Ag, Au, or Cu with a small diameter tip and high aspect ratio is ideal for TERS. The switchable stiffness AFM can work as a tool for imaging and placing the tip at the sub-nanometer proximity to a soft, molecular-scale biological sample, which would enhance the Raman signals.

\[\varepsilon_r(\omega) = \{\text{Im}\varepsilon_r(\omega), \text{Re}\varepsilon_r(\omega)\}\]

\[\omega [Hz] x 10^{15}\]

**Figure 1:** Dependency of frequency on the permittivity of silver. The negative sign of the real part of permittivity contributes to the enhancement of the electric fields near the metal surface.

**Figure 2:** Schematic of TERS showing the enhancement of electric fields near the metal tip or metal-coated CNT tip.

**REFERENCES**
