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# Binding of p-mercaptobenzoic acid and adenine to gold coated electroless etched silicon nanowires studied by surface-enhanced Raman scattering

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## Abstract

Modern diagnostic tools ever aim to reduce the amount of analyte and the time needed for obtaining the result. Surface-enhanced Raman spectroscopy is a method that could satisfy both of these requirements, provided that for each analyte an adequate substrate is found. Here we demonstrate the ability of gold-sputtered silicon nanowires (SiNW) to bind p-mercaptobenzoic acid in  $10^{-3}$ ,  $10^{-4}$  and  $10^{-5}$  M and adenine in 30 and 100  $\mu$ M concentrations. Based on the normal mode analysis, presented here for the first time, the binding of p-mercaptobenzoic acid is deduced. The intensity enhancement of the  $1106\text{ cm}^{-1}$  band is explained by involvement of the C-S stretching deformation, and the appearance of the broad  $300\text{ cm}^{-1}$  band attributed to S-Au stretching mode. Adenine SERS spectra demonstrate the existence of the 7H tautomer since the strongest band observed is at  $736\text{ cm}^{-1}$ . The adenine binding is likely to occur in several ways, because the number of observed bands in the  $1200 - 1600\text{ cm}^{-1}$  interval exceeds the number of observed bands in the normal Raman spectrum of the free molecule.

*keywords: silicon nanowires, normal mode analysis, substrate binding, biosensors, SERS, mercaptobenzoic acid, hot spots mapping*

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