Supporting information

Versatile Direct Laser Writing Lithography Technique for Surface Enhanced Infrared Spectroscopy Sensors (Supplementary material)

Avi Braun*, Stefan Alexander Maier

Blackett Laboratory, Department of Physics, Imperial College London, London SW7 2AZ, United Kingdom.

E-mail: a.braun@imperial.ac.uk

Abstract

We present the enhancement factors as function of antenna lengths for Si and glass samples with ~80 nm and ~300 of PMMA for 9 and 8 IR absorption peaks, respectively. These plots are equivalent to plot 7 in the main text, and likewise demonstrate that for probing with electrical field parallel to the long axis of the antennas, the enhancement factors vary with antenna length and have maximal enhancement factors for antennas with plasmon resonance near the absorption peak – an indication for the plasmonic source of the enhanced detection.

* To whom correspondence should be addressed

Figure S1 presents the enhancement factors as function of antennas length for 9 typical absorption peaks of PMMA ranging from 1440 to 2950 cm^{-1} (see main text for detailed description), where the enhancement factor is defined as the difference between the local minima and maxima of the absorption peaks, normalized relative to the difference between the local minima and maxima of the planar Au layer. Due to a larger refractive index of the Si substrate (~3.4 compare with ~1.4 of glass at the region of interest), the plasmon resonance are strongly red-shifted so that enhancement of the absorption peaks is *not* observed for the short-wavelength peaks for any of the tested antennas. For absorption peaks of 1275 cm^{-1} and lower wave-numbers, the maximum enhancement is achieved for antenna length with LSPR at 1315-1385 cm^{-1}. For transverse polarization ('P90'), the enhancement is practically invariant of antenna length with enhancement factors similar to the planar gold film.

For glass substrates covered with thick (~300nm) layer of PMMA (S2) we found similar dependence of the enhancement factor on antenna-length as for the glass substrates with 50nm of PMMA (figure 7 in the main text), albeit with lower enhancement values. The reduced enhancement for the thick PMMA sample is explained by the strong decrease in the electrical field at increasing distance from the antennas.

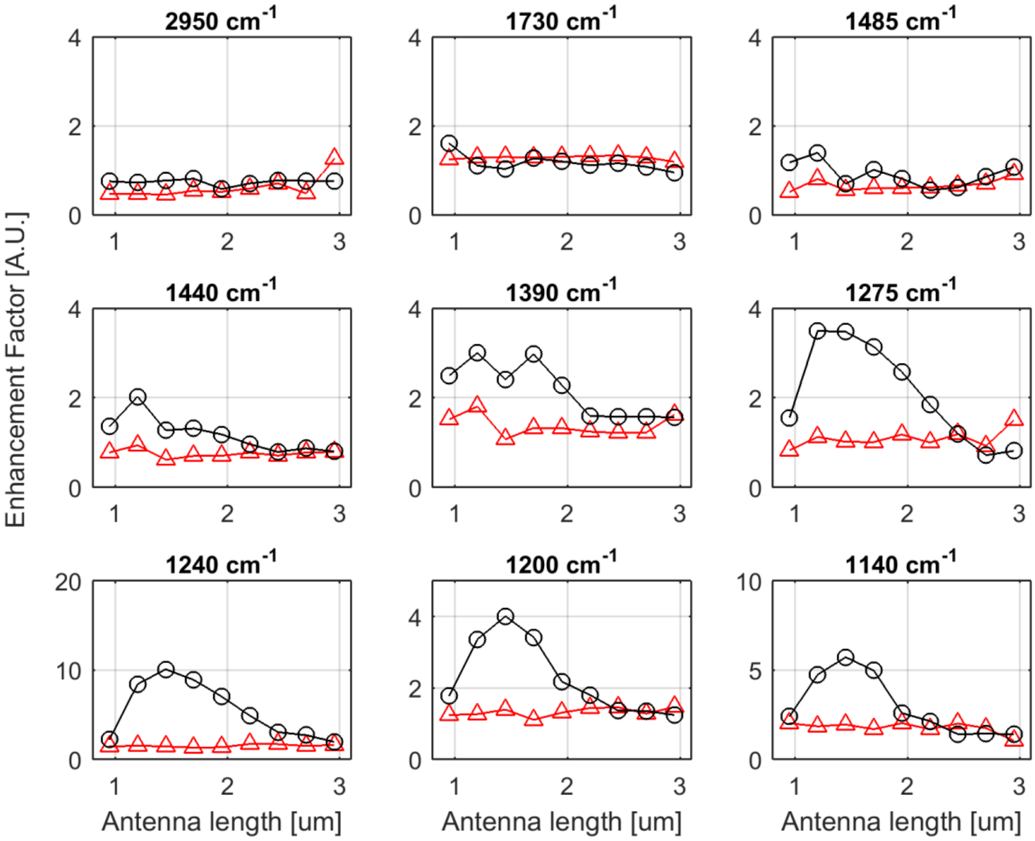

Figure S1: Enhancement of the absorption peaks as function of antenna length for a Si sample (Through Coverslip configuration) with ~80nm of PMMA. The curves circles (red triangles) are for probing light with polarized electric-field along (transverse) the long axis of the antennas. note the different scale for the different peaks.

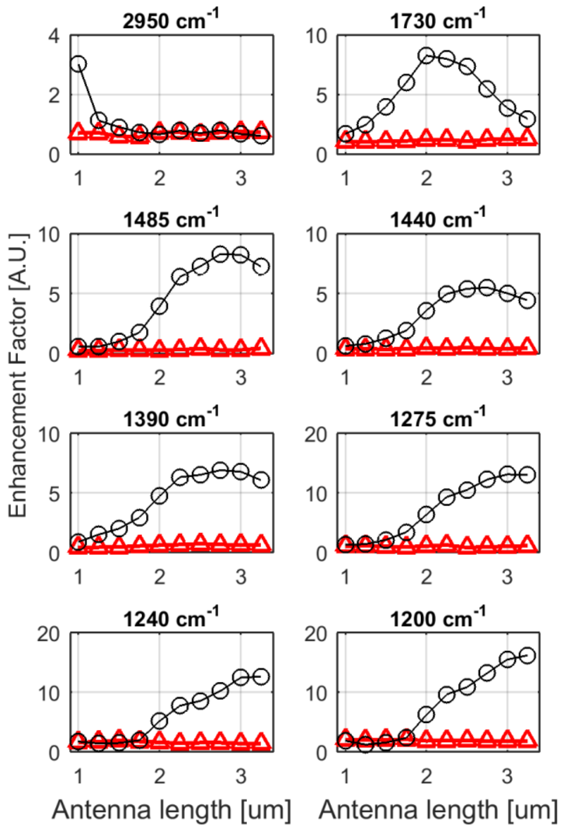

Figure S2: Enhancement of the absorption peaks as function of antenna length for a glass sample (through Substrate configuration) covered with ~300nm of PMMA. The black circles (red triangles) are for probing light with polarized electric-field along (transverse) the long axis of the antennas. note the different scale for the different peaks.