SAW-driven plasmons in graphene heterostructures for sensing ultrathin layers

Raúl Izquierdo-López[1,2]
Jorge Pedrós[1,2], Rajveer Fandan[1,2], Alberto Boscá[1,2], Fernando Calle[1,2]
[1]*Instituto de Sistemas Optoelectrónicos y Microtecnología, Universidad Politécnica de Madrid, Av. Complutense 30, Madrid 28040, Spain*
[2]*Departamento de Ingeniería Electrónica, E.T.S.I de Telecomunicación, Universidad Politécnica de Madrid, Av. Complutense 30, Madrid 28040, Spain*
raul.izquierdo@upm.es

In this work, the large confinement of graphene plasmon polaritons in the mid-IR is exploited to strengthen light-matter interactions for surface enhanced IR absorption (SEIRA) spectroscopy [1-3]. In particular, a transfer matrix method has been used to simulate the interaction of ultrathin polymer layers with graphene/h-BN heterostructures on piezoelectric substrates, where a surface acoustic wave (SAW) can be used to couple far field light into plasmon-phonon polaritons [4]. Figure 1 shows an example of the sensing performance of such plasmonic structure with a 2-nm thick 4,4'-bis(N-carbazolyl)-1,1'-biphenyl (CBP) layer. Besides a frequency shift and a drop in intensity, a Fano-type interference dip appears at the plasmon-phonon polariton peaks when tuned at the frequency of the molecular vibrations of CBP, allowing the fingerprinting of the polymer.

References

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Figures

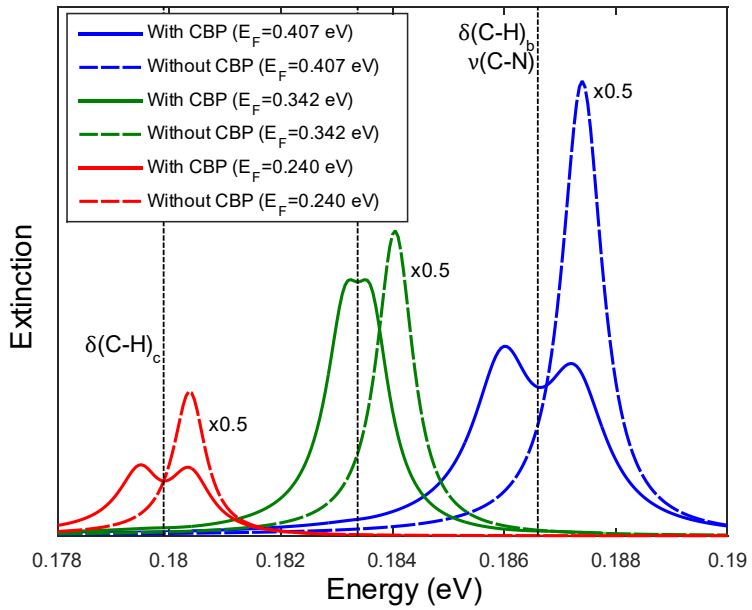

Figure 1: Light extinction by a plasmonic graphene/h-BN/graphene/AlN heterostructure covered by a 2 nm-thick CBP layer (solid colour curves), tuned by means of the Fermi energy E_F of graphene. The plasmonic signals without CBP are also shown (dashed colour curves). *δ* and *ν* correspond to the deformation and stretching modes of CBP, respectively, whereas *c* and *b* refer to their dominant localization on the carbazolyl and biphenyl groups, respectively.