**Molecular Specificity in the Intense Surface Enhanced Raman Scattering on Copper-(II)-8-hydroxyquinoline Microcrystals**

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**Abstract**

π-conjugated microcrystals of metal complexes are extensively used in catalysis, sensing, and as biomedicines. However, their application as surface-enhanced Raman scattering (SERS) substrates is unexplored. SERS substrates with ease of tailoring and that provide molecule-specific enhancement are desirable for selective detection of diverse species. Nonetheless, the rational design of such SERS substrates is difficult for conventional metal and semiconductor-based materials. We show that π-conjugated copper 8-hydroxyquinolinate (CQ) microcrystals exhibit molecular specificity in SERS enhancement. CQ microcrystals show unprecedented Raman signal enhancements up to 28372±1953 for probe molecule rhodamine-6G, 13407±1969 for rhodamine B and 12816±900 for copper-(II)-picolinate complex at 785 nm laser excitation. Experiments also revealed that Raman signal enhancements of binary mixtures over CQ microcrystals could be analyte specific. Computational analyses demonstrate that π-electron-rich CQ microcrystals are very electron-dense, and band structure calculations show that it possesses metallic properties along all crystallographic axes. Combination of metallicity and high electron density in a metal complex microcrystal resulted in unique features such as good analyte selectivity and efficient SERS activity.

**Student Academic Board (SAB), Indian Institute of Technology Guwahati, Guwahati, Assam, India**

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**Keywords: Crystals, Lasers, Molecules, Plasmonics, Raman Spectroscopy**

