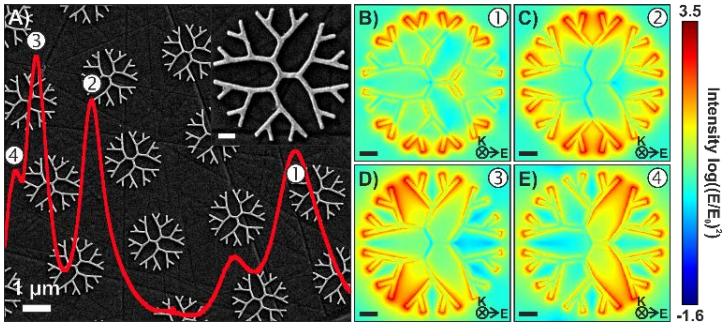
Fractal Plasmonics: Optical Properties from the Visible to the mid-IR Spectral Range

Dr. François Lagugné-Labarthet

Department of Chemistry,
Western University,
London ON, N6A 3K7
Canada.

Metallic nanostructures that exhibit tunable plasmon resonances on a broad spectral range are of particular interest for a variety of optical processes where the excitation and/or the emission could be enhanced. We explore here the properties of fractal metamaterials that have resonances spanning from the visible to the mid-infrared range that can be exploited for a variety of applications including sensing applications and nonlinear optics. Surface-enhanced Raman spectroscopy and surface-enhanced infrared absorption are used to probe a variety of surface and interfacial enhancements. Electron Energy Loss spectroscopy (EELS) is also a key technique to reveal optical modes and how they hybridize along the different fractal generations. In this seminar, we present several metastructures based on fractal geometries that exhibit multiple localized surface plasmon resonances across the Visible to the mid-infrared spectral regions. [1-4]



A)SEM image of fourth-order three branched dendritic fractals. Overlaid on the image is the infrared absorption spectrum of the structure. B-E) Finite difference time domain calculations of the electric field distribution at wavelengths corresponding to the numbered resonances.

Recently published work from our group in the field:

1. Carving Plasmon Modes in Silver Sierpiński Fractals, ACS Photonics, 2019, 6, 2974.
2. Probing mid-infrared plasmon resonances in extended radial fractal structures, Opt. Lett., 2019, 44, 3865
3. Advancements in fractal plasmonics: structures, optical properties, and applications, Analyst, 2019, 144, 13.
4. Exploiting Anisotropy of Plasmonic Nanostructures with Polarization Modulation Infrared Linear Dichroism Microscopy (µPM-IRLD), Adv. Opt. Mater., 2018, 6, 1701336.