Development of a diamond waveguide sensor for ultra sensitive chemical analysis using tunable mid-IR quantum cascade lasers

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Country

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Development of a diamond waveguide sensor for ultra sensitive chemical analysis using tunable mid-IR quantum cascade lasers

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4

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Research Abstract

The project is aimed to develop a sensitive chemical sensor based on a microfabricated diamond waveguide. By coupling mid-IR light into a macroscopic diamond crystal FTIR-ATR spectroscopy can be performed. The light is reflected 1-9 times inside the crystal and chemical information from the analyte is collected. FTIR-ATR are commercial available and found in many laboratories. We intend to fabricate a thin diamond waveguide, this to reach several

hundred of internal reflections. The number of reflection is directly related to the sensitivity of the sensor. A problem with a thin waveguide, besides the needs for microfabrication methods, is the light sources today used are too week for couple mid-IR light through the waveguide. This miniaturized and potentially very sensitive sensor has therefore never been exploited. In this proposed project we overcome the hurdles by using our newly developed processes for fabrication of complex optical micro- and nanostructures in diamond for mid-IR applications, and in combination with using new types of tunable quantum cascade laser as the mid-IR light source. This is a label free method giving unique signatures for each biomolecule. In addition we solve problems with overlapping IR-spectrum from complex mixtures by coating the waveguide with a thin layer of nanocrystalline diamond (NCD). The NCD layer can be functionalized for fishing out relevant biomolecules, which we have recently shown by capturing C-reactive protein to NCD surfaces.

Further information available at:

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Investments < €500k

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