COMPUTER MODELLING OF WGM MICRORESONATORS WITH A ZINC OXIDE NANOLAYER USING COMSOL MULTIPHYSICS SOFTWARE

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The WGM (whispering gallery mode) microresonators are spherical or cylindrical optical structures where light can "rotate" inside due to total internal reflection. When an integer number of light waves fits into the perimeter of the microresonator, constructive interference takes place and resonance occurs. It`s described by Eq. (1), where n is the refractive index:

$$N\lambda = 2\pi Rn, \quad (1)$$

The quality factors of WGM microresonators are very high ~10^6, so the resonant frequency is narrow, which is good for using a laser and having a precise measurement. The WGM microresonators are sometimes called the morphologically dependant resonators because the resonant frequency is dependent on the form of the microresonator. Small changes in the environment are picked up by microresonators changing their radius or refractive index, thus changing the resonant frequency. This allows WGM microresonators to be used as sensors.

Sometimes it`s good to coat the microresonator with an extra layer, for example, a zinc oxide layer. This layer helps to later stick antigens for biosensing. The effects of adding this extra layer can be simulated using COMSOL Multiphysics software. The extra layer changes how close to the surface the light is propagating and ads extra modes. Various methods are used for exploration of this topic such as using random functions to better describe the roughness of the surface, witch in micro and nanoscale makes a difference.