
Optical sensor based on a diffraction grating combined with a hydrogenated amorphous silicon layer

Rosa Darell Olloghe Mandoukou^{*1}, Isabelle Verrier^{†1}, Maxime Royon^{‡1}, Maxime Darnon^{§1}, Damien Jamon^{¶1}, Arnaud Meyer^{||1}, Laurent Dubost^{**2}, William Ravisy^{††2}, Gerges El Haber^{‡‡2}, and Yves Jourlin¹

¹Laboratoire Hubert Curien (LabHC) – Institut d’Optique Graduate School, Université Jean Monnet - Saint-Etienne, Centre National de la Recherche Scientifique – Bâtiment F 18 Rue du Professeur Benoît Lauras 42000 Saint-Etienne, France

²Institut de Recherche en Ingénierie des Surfaces (IREIS) – Groupe HEF – Avenue Benoît Fourneyron ZI Sud - CS4207742162 ANDREZIEUX-BOUTHEON Cedex, France

Abstract

The use of optical sensors has grown considerably, both in air quality control applications and in the detection of biological species. The design of optical sensors based mainly on diffraction gratings generally requires probing the structured metal surface from above. This approach, subject to the use of plasmon surface resonance (SPR), can prove limiting, as the reflected signal can be disrupted by absorption or scattering of the signal as it passes through the various gases or solutions to be analyzed. This is why, to counter this problem, a dielectric approach has been envisaged, proposing to probe from above. To achieve this, a very high-index layer that is transparent at the wavelengths of use is required, hence the choice of hydrogenated amorphous silicon. The grating combined with this thin film generates resonances and energy transfers between the diffracted 0 and -1 orders used for our detection (1-4).

Keywords: Resonant diffraction grating, dielectric waveguides, hydrogenated amorphous silicon, energy transfer, optical sensor

^{*}Speaker

[†]Corresponding author: isabelle.verrier@univ-st-etienne.fr

[‡]Corresponding author: maxime.royon@univ-st-etienne.fr

[§]Corresponding author: maxime.darnon@univ-st-etienne.fr

[¶]Corresponding author:

^{||}Corresponding author: arnaud.meyer@univ-st-etienne.fr

^{**}Corresponding author: ldubost@hef.group

^{††}Corresponding author: wravisy@hef.group

^{‡‡}Corresponding author: gelhaber@hef.group

Corresponding author: yves.jourlin@univ-st-etienne.fr