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Design of a photo-written cavity neodymium doped fibre laser, tunable around a particular absorption molecular line

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Abstract :

Experimental works have shown it is possible to realize photo-written cavity lasers with rare earth doped silicate fibres. Most of these new laser sources can be pumped by market laser diodes, what makes them valuable for their integration in system. Furthermore, their laser effect threshold (1-2 mW), their spectral width (a few GHz), their conversion rate, close to the theoretical value and their wavelength tunability allow their use in a wide range of applications such as telecommunications, sensors, etc ...

We present here experimental results on a particular application of this kind of lasers in the field of detection of a gas by identification of one of its absorption lines by use of classical linear spectroscopic methods. We have carried out our experiments on an absorption line of water.

We present first the making process of the fibre lasers and the method used to insure their tunability around the selected absorption line of water. Two lasers have been designed for this work. We give their respective characteristics, i.e. their spectral width, slope, polarisation state and we compare them with the theoretical values.

Secondly, we give the absorption spectra obtained with both these lasers scanning their wavelength. These spectra consist on the detected light intensity versus the laser wavelength with the laser beam freely propagating through a few meters of absorbing medium.

At least, we present the preliminary experimental results on the optoacoustics detection of an absorption line of water obtained using the fibre laser having the best characteristics. The obtained curve gives the detected acoustic power versus scanned wavelength range using a non optimized acoustic cell of a few cm long containing air at room pressure and temperature.