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Analysis of oxygen emission in RF plasma of CO2 andO2 mixtures

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The optical emission spectroscopy (OES) offers the possibility to analyse in real-time, atomic species, molecules and radicals forming the plasma by using a quite compact and robust experimental set-up. This equipment can be used, for example, as a non-invasive device for the control of technological processes with gas emission. The light emitted from the plasma can nowadays be efficiently analysed by using compact UV-VIS NIR spectrometers, which show increasingly low noise level, high sensitivity with nearly a sub-nanometer resolution, thanks to the development of back-thinned CCD coupled to holographic gratings. In this work, the emission spectrum from mixtures of CO_2 and O_2 for the control of technological processes in which carbon dioxide is produced starting with pure oxygen was analysed. The plasma emission spectra contain in particular, the intense emission lines of the atomic oxygen which are originated not only from the break of O_2 bond, but also by the dissociation of CO_2. In this work, the ratios between the emission intensities of the vibrational levels ($0 \rightarrow v$) with$v$ = 0,1,2,3,4,5 associated with the Ångström series ($B^1\Sigma+ \rightarrow A^1\Pi$) in CO and the molecular transition $b^1\Sigma^+_g \rightarrow X\ ^3\Sigma^-_g$ in O_2 ,together with the electronic disexcitation between the triplet $3p^5P$ -> $3s^5S^0_2$ centered at 777.2 nm and related to the atomic oxygen were analysed as function of pressure and the RF power applied. In particular, by correlating the behaviour of the peaks areas of atomic oxygen emission at 777.2 nm with the vibrational transition in the CO at 519.8 nm, the variation of the O_2 concentration in the mixture was estimated.

Keywords
optical emission spectroscopy
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