SURFACE ENHANCED RAMAN SPECTROSCOPY OF HEMOGLOBIN-NANODIAMOND SYSTEMS

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Abstract

We have performed a Surface Enhanced Raman Spectroscopy (SERS) of Red Blood Cells (RBC) incubated with carboxylated nanodiamonds for studying the ferrous spin states of hemoglobin (Hb). The change from oxygenated tense form (low spin state) to deoxygenated relaxed form (high spin state) induced with ionizing gamma radiation was analyzed. The SERS spectra show well-defined peaks located at 1588 cm^{-1} for OxyHb and 1604 cm^{-1} for DeOxyHb present at all radiation doses. It was observed an evolution from tense form to relaxed form of Hb due to stressing energy. These results agree with previous reports for colloidal Ag suspensions used as Raman Hb markers. With the use of nanodiamonds we were able to follow the absorbed dose-DeOXyHb evolution. Also, we carried out the structural studies of RBC in the same stages with non-contact AFM to evaluate their aspect ratio. We found that for high gamma radiation dose (50 Gy) the circular form of RBC was altered to elliptical shape. These experimental insights are very valuable to determine the health of RBC, particularly for pathologies related with the compromised ability to transport oxygen or cell membrane deformations in radiotherapy procedures.

Keywords: SERS, Nanodiamond, RBC

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