RamanFest
July 02-03 2025
Frankfurt | GERMANY

Pablo Rabasco[1]
María Fernández-Álvarez[1], Davide Novella[2], Esther Gómez[3], Vicente García-Juez[3], José Francisco Fernández[1], Alberto Moure[1]
1-Instituto de Cerámica y Vidrio (ICV), CSIC, Kelsen 5, 28049, Madrid (Spain)
2-Dipartimento di Geoscienze, Padova University, Via Giovanni Gradenigo, 6, 35131 Padova (Italy)
3-Burgos Paper Mill, Fábrica de Moneda y Timbre-Real Casa de la Moneda (FNMT-RCM), Av. Costa Rica 2, 0900, Burgos (Spain).

pablorabas@icv.csic.es

Raman spectroscopy and chemometric study of feldspathic glass-ceramic for anti-counterfeiting applications

Silica glass-ceramic materials based on feldspars exhibit an enhanced Raman signal in the region of 1000-2500 cm^{-1} for 785 nm excitation wavelengths, consisting of a series of bands associated with luminescent-related processes [1-3]. The shapes and intensities depend on the interaction between the glassy and crystalline components of the microstructure. This particular response provides these materials with new functionalities and innovative applications, as the Raman spectra can be served as security markers for authentication of documents and valuables [4]. This study presents the characterization of a series of glass-ceramic materials obtained by high temperature sintering (≥900ºC) of mixtures of a glass composition and alumina as nucleating agent. The different microstructures obtained from compositional variations of glass/nucleant and sintering temperature were analyzed by Raman spectroscopy and high-resolution confocal Raman microscopy. Two excitation wavelengths lasers (532 and 785 nm) were employed to discriminate structural and luminescence functional signals, respectively, in order to explain the role of glass and crystalline phases in the enhanced Raman response. Differences in the Raman spectra, which provide the anti-counterfeiting capability in security applications, were quantified by chemometric and spectral correlation studies. In this way, this work demonstrates the possibility of manufacturing materials that opening up a new pathway for anti-counterfeiting applications.

References

[1] Fikiet, M. A., Tuschel, D. Ermolenkov, V. V., Lednev, I. K., Applied spectroscopy, 2020, 74(2), 187-192.
[2] Tuschel, D., Spectroscopy, 2016, 31(9), 14-21.
[3] Kamura, S., Tani, T., Matsuo, H., Onaka, Y., Fujisawa, T., Unno, M., ACS Omega, 2021, 6, 7829-7833..
[4] Moure, A., Fernández, J. F., Fuertes, V., Enríquez, E., García, V., Raman markers, 2019, EP19382045.3.

Figures

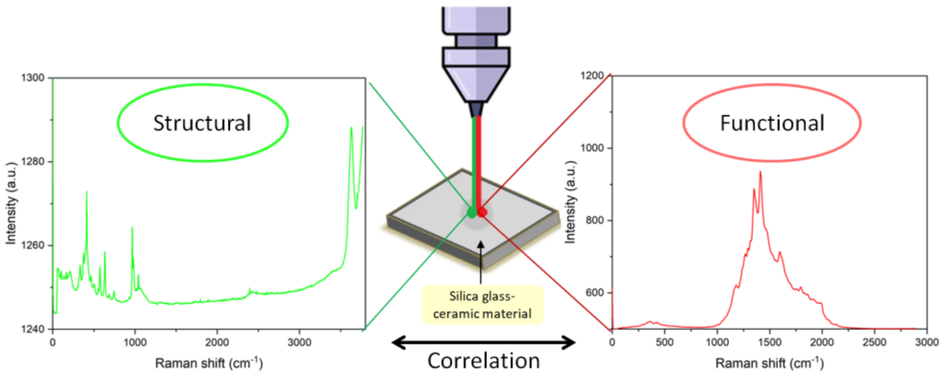

Fig.1 Scheme of the discrimination between structural and functional Raman signal.