Modified zeolites with cations, clusters and metallic nanoparticles are of interest due to the possibility to develop materials with new properties [1]. A study concerning the thermal reduction under hydrogen flow of mixed bimetallic system Cu2+ and Ag+ exchanged natural clinoptilolite Tasajeras deposit, Cuba is presented. The influence of silver in the reduction of Cu2+ was studied. X-Ray diffraction experiments on natural clinoptilolite, as well as on ion-exchanged monometallic and bimetallic samples were performed. The peak intensities of the exchanged samples, are changed as a result of the ion exchange, and they are fundamentally associated with differences in nature, amount and position of the extra-framework ions in the channels of the natural zeolites [2, 3]. The fig 1 shows the magnitude of the Fourier Transform (FT) for the EXAFS signals of the natural clinoptilolite exchanged with Cu2+ and of the natural clinoptilolite exchanged with both Cu2+ and Ag+ and reduced at 150 oC . The FT of the experimental EXAFS signal of metallic Cu, has been also added. The amplitude of the peak at 1.82 Å, associated with the coordination of Cu2+ with 4 oxygen atoms, decreases upon Cu was added. A detailed analysis of the graph reveals also that for the exchanged and reduced samples a peak at 2.58 Å begins to emerge. This maximum coincides with the first maximum of the metallic Cu and may be associated with the formation of small clusters of Cu. The addition of Ag+ favors the decrease of the reduction temperature of Cu2+. The reduction of Cu2+ and Ag+ cations shows existence of notable interinfluence between both cations during this process. The Cu2+ reduction is favored by the presence of Ag+. The aggregation of the reduced highly dispersed species both for copper and silver is limited in this bimetallic system. The introduction of Ag+ as the second cation in the copper exchanged zeolites appears to be an efficient tool for the control of the size of the resultant reduced nanoparticles.


Keywords: Natural Zeolite, Nanoparticles, X Ray Diffraction (XRD), Extended X-Ray Absorption Fine Structure (EXAFS)