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Far-infrared spectra for copper–zinc mixed ferrites

H.M. Zaki^{a,b}, H.A. Dawoud^c^a Physics Department, Faculty of Science, King Abdul Aziz University, Jeddah, Saudi Arabia^b Physics Department, Faculty of Science, Zagazig University, Egypt^c University of Gaza, P.O. Box 108, Gaza Strip, Palestine Physics Department

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ABSTRACT

Infrared spectra of Zn^{2+} ions substituted Cu ferrites with the general formula $\text{Cu}_{1-x}\text{Zn}_x\text{Fe}_2\text{O}_4$ (where $x=0.0, 0.2, 0.4, 0.6, 0.8$ and 1) have been analyzed in the frequency range $200\text{--}1000\text{ cm}^{-1}$. These mixed ferrites were prepared by the standard double sintering ceramic method. Two prominent bands were observed, high-frequency band ν_1 around 550 cm^{-1} and low-frequency band ν_2 around 395 cm^{-1} and assigned to tetrahedral and octahedral sites for spinel lattice, respectively. On introducing zinc ions IR spectra indicate new shoulders or splitting on tetrahedral absorption bands around 600 and 700 cm^{-1} . A small absorption band ν_3 was observed around 310 cm^{-1} . This indicates the migration of some Zn^{2+} ions to octahedral site. Another small weak absorption band was also observed around 265 cm^{-1} ; its intensity increased with Zn content. Force constant was calculated for both tetrahedral and octahedral sites. Threshold frequency ν_{th} for the electronic transition was determined and found to increase with an increase in Zn ions. The half bandwidth for each site was calculated and the ratio seemed to increase with an increase in zinc content. The cation distribution for these ferrites was estimated in the light of IR spectra.