Thermal and spectroscopic investigations of nanocrystalline calumetite-$Cu(OH,Cl)_2$. 2 H_2O

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We present here for the first time the temperature dependence of electron paramagnetic resonance studies on the naturally occurring calumetite from a copper mine, Rajasthan, India, in the low-temperature range of 120 to 295 K, using JEOL-FE-IX ESR spectrometer [1]. The composition of the prepared sample is determined as CuO (52.84 wt % to 52.46 wt %); Cl (23.16 to 23.54 wt %) and the loss of ignition is about 24 wt %. The room temperature EPR spectrum of calumetite exhibits one intense, unresolved parallel component centered at g_{II} = 2.235 and three well resolved perpendicular components centered at g = 2.111. These resonance signals are a characteristic of Cu^{2+} ions in distorted octahedral symmetry. The EPR spectra have also been recorded at low temperatures in 123-295 K range. The intensity of the resonance signals is found to increase gradually with decrease in temperature in 123-295 K range. The population of spin is found to increase with decrease in temperature obeying the Boltzmann distribution law. DTA trace shows two endothermic reactions at about 378 and 598 K, which are attributed to dehydration of the sample. The exothermic peak at about 650 K is due to solid –soli phase transition, which is typically observed in any hydrous minerals [2]. Thero-gravimetric analyses (TG) data demonstrates the weight loss of the sample up to 24 wt % in the temperature region of 600 to 700 K, the value agrees with the compositional data. Temperature induced dehydration occur in different stages viz., first at about 380 K, with a loss of 5 % weight loss and the second reaction at about 600 K with a weight loss of 10 %. The present study reports for the first time the thermal phase stability of the sample up to 700 K.

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Effect of land use changes on rainfall-runoff and runoff-sediment relationships in Gaula catchment of Himalayan region

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Land use change is expected to have a greater impact on gully erosion than climate change. Land uses exert a significant influence on the relations of rainfall-runoff and/or runoff-sediment and alter soil and water loss accordingly. Study of the land use changes and their effects on runoff and sediment patterns for the watershed level are essential in water resource planning and management. This study provides an approach to identify the effects of land-use changes on rainfall-runoff and runoff-sediment relations in Gaula catchment of Himalayan region. The study was based on the comparison of the effect of land-use changes during the periods, 1962-63, 1973, 1985-86, and 2005-06. The study objectives were to identify the change of land-use in that years and analyze its effects on rainfall-runoff and runoff-sediment relationships. In this study, double mass curve with trend curve have been used to examine the effect of land use changes on rainfall-runoff and runoff-sediment relationships. The results showed that the land-use change can be considered as main reason for increased runoff and sediment in the catchment. The annual rainfall, annual runoff and sediment load for the period 1958-2005 are investigated. The annual slope of trend curve (STC) of rainfall-runoff in 1968-1977 is more than that in 1958-1967, 1978-1986 and 1986-2005. It represents the accumulative annual runoff increases more rapidly from 1968 to 1977 than that from 1958-1967, 1978-1986 and 1998-2005. The runoff yield in 1968-1977 is more than that in the other comparative series with similar rainfall. The runoff-sediment relationship exhibits that more runoff and sedimentation occurred in the period 1996-2005 than the other periods. The change of land-use in the study periods altered the rainfall-runoff and runoff-sediment relationships.