ABSTRACT

In our search for suitable radar absorbing materials (RAM) in the form of paints/surface coatings and composites with special reference to the X-band frequency region covering from 8-12 GHz, we had explored the utility of spinel ferrites obtained from industrial wastes/effluents in the form of a dispersed phase in polymer matrix. Sol-gel technique has been used to synthesize various ferrites both from analytical grade reagents and industrial effluent/wastes. In the latter case it not only provided us ferrites as a cheap by-product but also helped us in purification of the waste water containing heavy metal ions and thereby decreasing the industrial pollution. Optimization of the sol-gel technique has been achieved by studying the effect of various parameters on the ferrite end products. Subsequently, these ferrites were extensively characterized for confirming their chemical structure, purity, stoichiometric composition etc. It has been shown that these ferrites as prepared from waste effluent when used in the form of epoxy based paints (3 mm thick) provided 90% absorption over 8-12 GHz frequency region. It has also been found that low addition of free iron powder (1-10 wt%) further enhances the absorptivity of the system. Some physico-mechanical

properties of ferrite-epoxy composites have also been studied to understand their mechanical integrity, practical adhesion with substrate, weatherability etc. In addition, an effort has also been made to study extensively their dielectric behaviour both at audio frequency region (10^2-10^7 Hz) and X-band microwave region (8-12 GHz). Mechanistic explanation for the abnormal dielectric behaviour of the epoxy-ferrite composites in audio range has also been put forward. Ultimately, an effort has been made to correlate the microwave dielectric loss behaviour and the absorptivity of the ferrite-epoxy composites.

Keywords: Ferrites, Sol-Gel Synthesis, Microwave Absorptivity, Dielectric Properties, Physico-mechanical Properties.