AC conductivity and shielding parameters

The σ_{ac} can be correlated with the shielding parameters of the material. Fig 9 (a) shows plot of SE_A against $(\sigma_{ac})^{1/2}$, it is observed that SE_A increases with increasing $\sigma_{ac,}$ authenticating the Eq. 6. Fig 9 (b) exhibits dependence of skin depth on frequency, skin depth is calculated by, $= \sqrt{2/\omega\mu\sigma_{ac}}$. It is observed from the figure that skin depth decreases with increasing frequency which is in accordance with the expression given for skin depth. The decrease in skin depth from 1.6 to 1.33 mm with the increase in frequency is responsible for the enhancement of SE_A at higher frequency. The dependence of SE_R as a function of log σ_{ac} is shown in Fig 9 (c) while Fig 9 (d) shows the variation of σ_{ac} with frequency for the composite PUPCNT3 as evaluated from dielectric measurements ($\sigma_{ac} = 2\pi f \varepsilon_0 \varepsilon''$). Hence, a reasonable value of conductivity (σ_{ac}) is necessary for less value of SE_R.

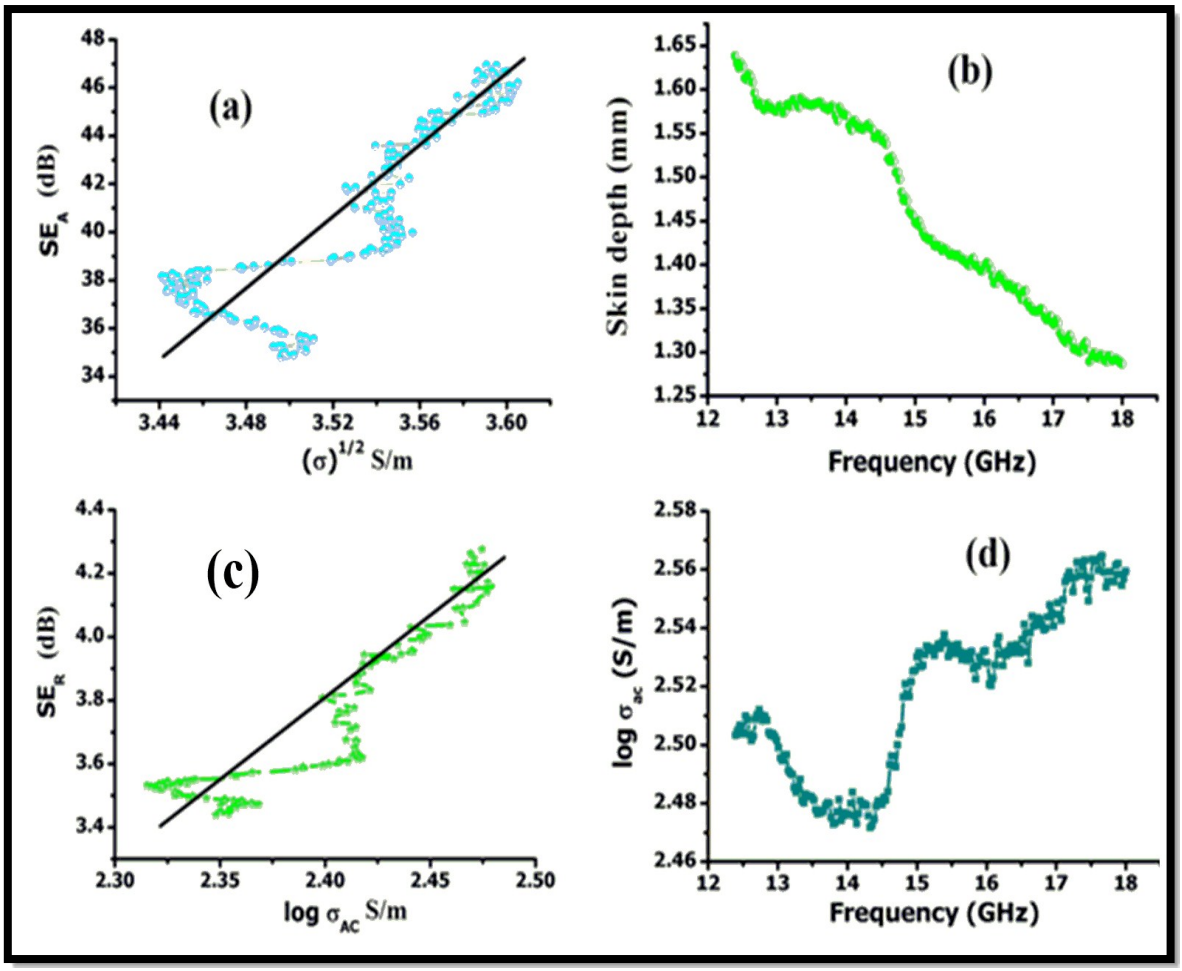

Fig 1 (a) Dependence of SE_A as a function of $(\sigma_{ac})^{1/2}$, (b) variation of skin depth of PUPCNT3 composite with frequency, (c) dependence of SE_R as a function of log σ_{ac} and (d) variation of σ_{ac} as a function of frequency at room temperature

Attenuation constant:

The attenuation of EM wave inside the material is one of the key elements for an excellent absorbing shield. The attenuation constant α, which governs the attenuation properties of material, can be expressed as:

$$a = \frac{\sqrt{2}\pi f}{c} \times \sqrt{(\mu''\varepsilon'' - \mu'\varepsilon') + \sqrt{(\mu''\varepsilon'' - \mu'\varepsilon')^2 + (\mu'\varepsilon'' + \mu''\varepsilon')^2}}$$

where, f is the frequency of the EM wave and c is the velocity of light. Fig 11(d) shows the variation of attenuation constant in the frequency range of 12.4-18 GHz. From the figure it is observed that PUPCNT3 composite has prominent attenuation constant than PUP3 over the whole frequency range, confirming its excellent wave absorbing properties.

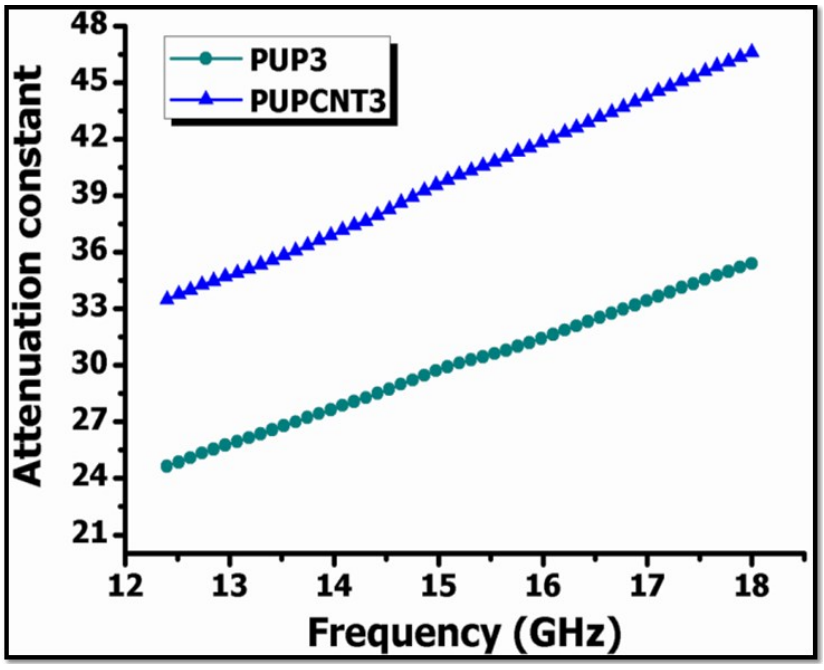

Fig 2 Attenuation constant of PUP3 and PUPCNT3 composites