Supplementary Materials

Figure **S1-S9** shows the variation of electromagnetic parameters for mortar with EP content. It can be found that the real and imaginary parts of the dielectric constant gradually decrease as the EP content increases, while the magnetic permeability and the loss angle tangent hardly changes with the increase of EP content, which indicates EP is a good wave transmitting material that hardly loses EM waves.

Figure **S10** shows the reflection loss of single layer samples 11-100 with a 20 mm thickness at different EP content. Figure **S11** and Figure **S12** show the reflection loss of single layer samples 1-100 with a 40 mm thickness at different EP content. Figure **S13** and Figure **S14** show the reflection loss of single layer samples 1-100 with a 60 mm thickness at different EP content.

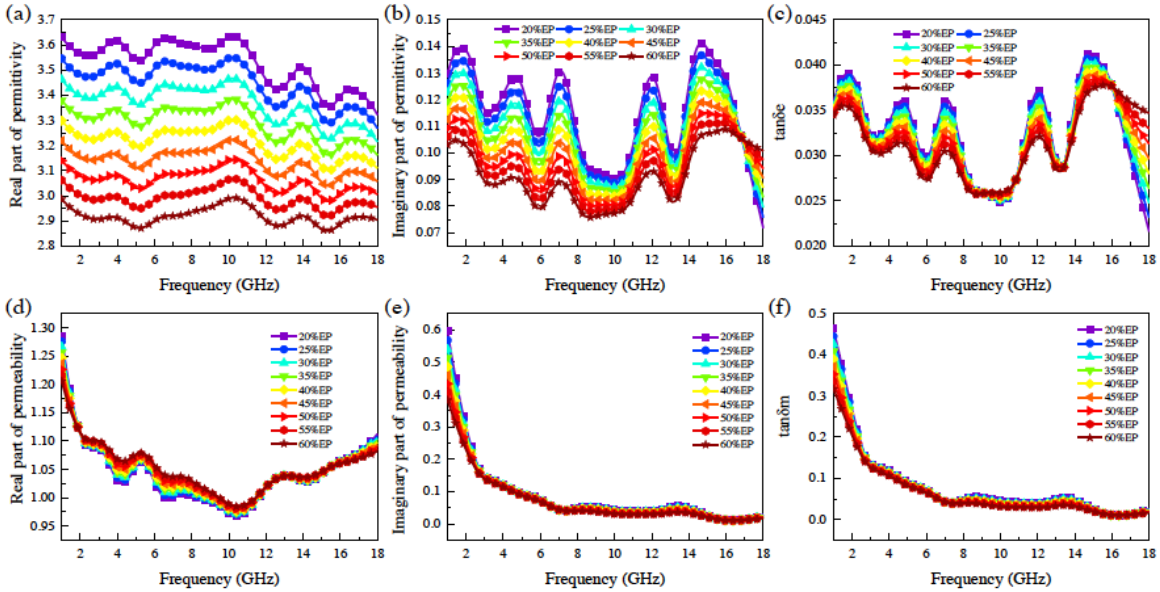

Figure S1: Frequency dependence of EM parameters for mortar (10%WIP)/paraffin composites with different EP content (samples 12-20, Data identification is unified).

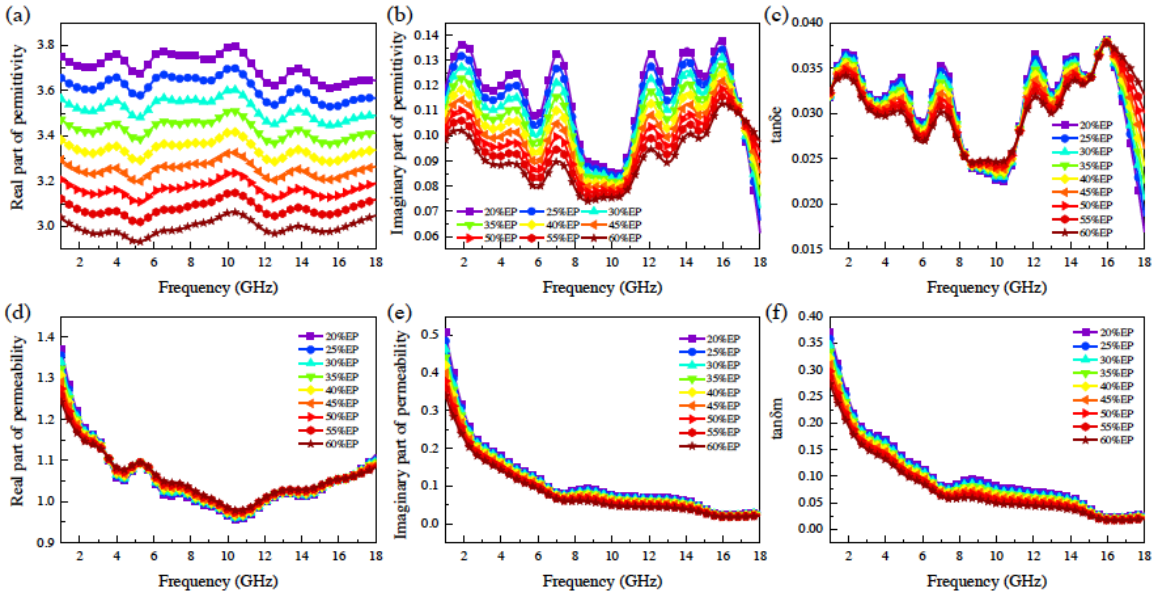

Figure S2: Frequency dependence of EM parameters for mortar (30%WIP)/paraffin composites with different EP content (samples 22-30, Data identification is unified).

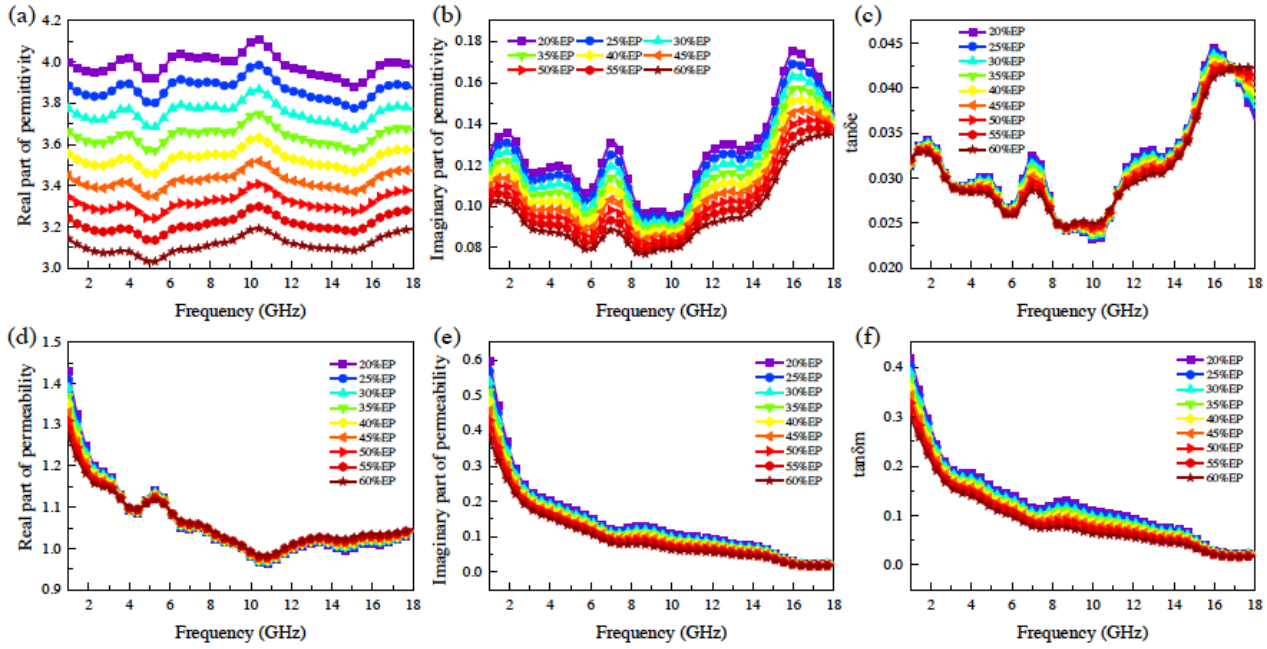

Figure S3: Frequency dependence of EM parameters for mortar (50%WIP)/paraffin composites with different EP content (samples 32-40, Data identification is unified).

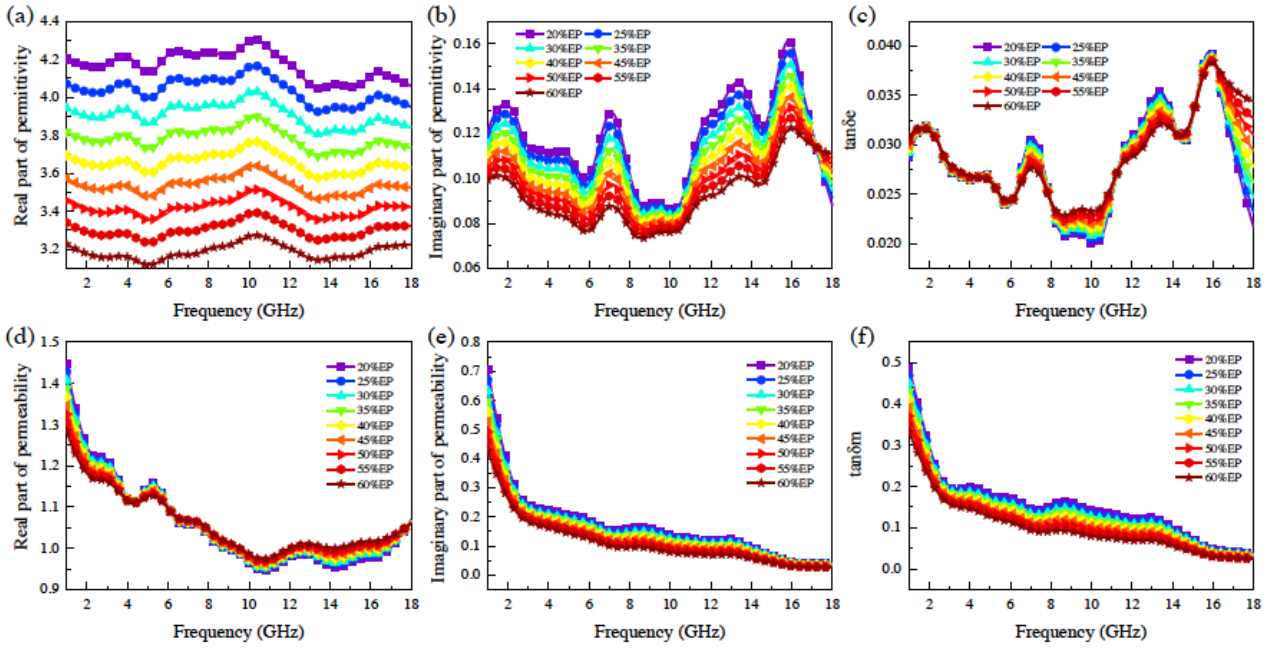

Figure S4: Frequency dependence of EM parameters for mortar (70%WIP)/paraffin composites with different EP content (samples 42-50, Data identification is unified).

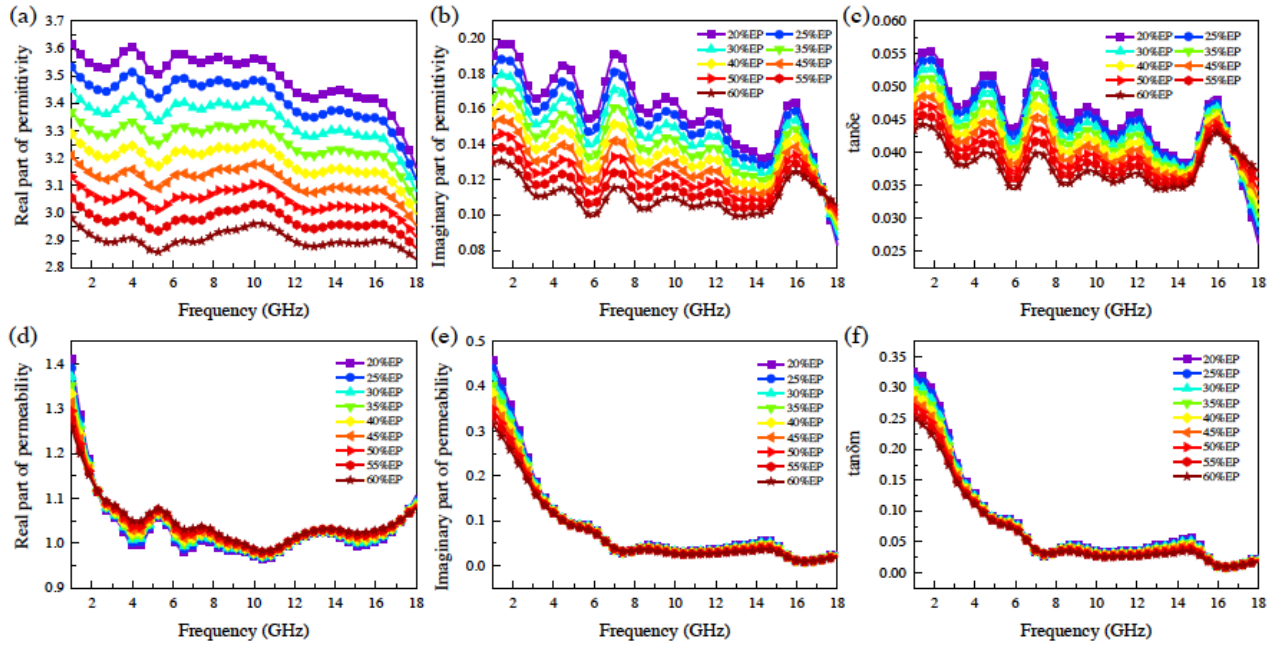

Figure S5: Frequency dependence of EM parameters for mortar (0%WIP+2%CB)/paraffin composites with different EP content (samples 52-60, Data identification is unified).

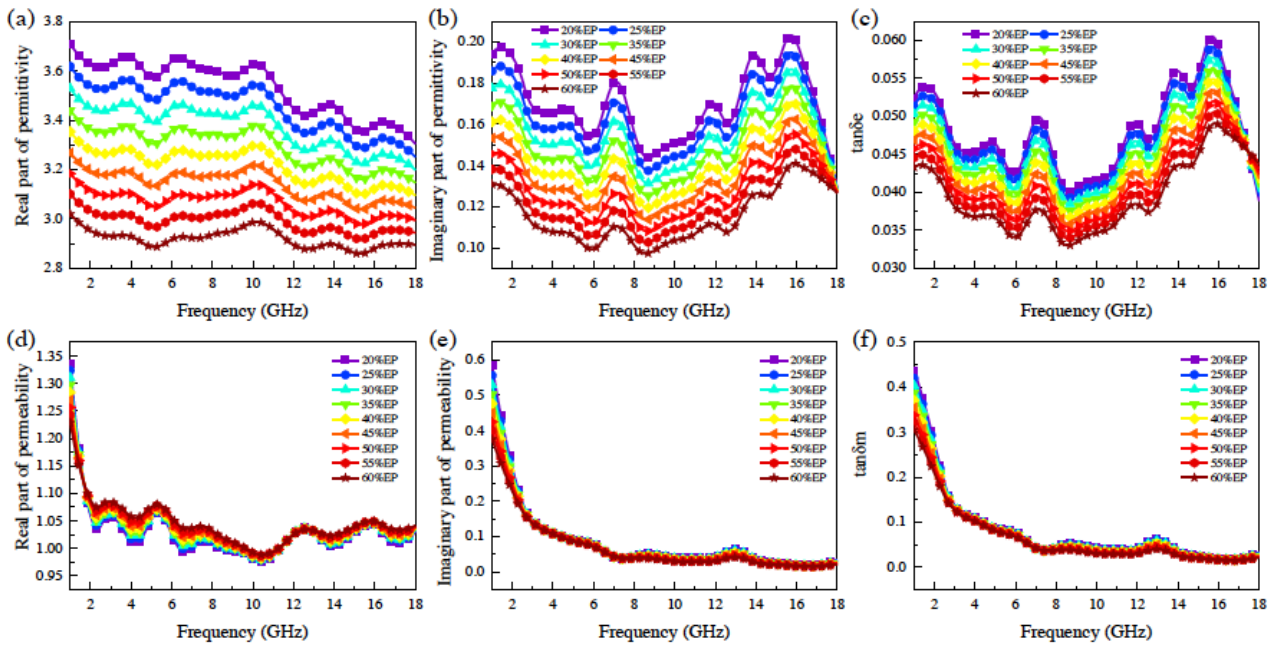

Figure S6: Frequency dependence of EM parameters for mortar (10%WIP+2%CB)/paraffin composites with different EP content (samples 62-70, Data identification is unified).

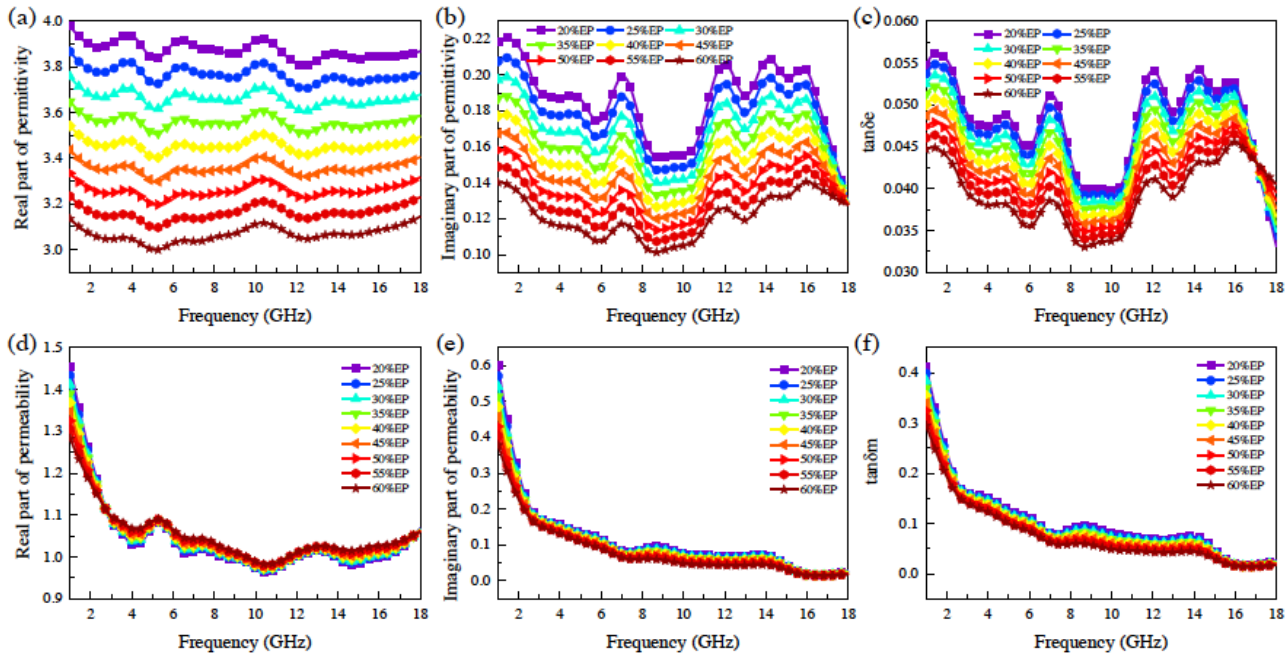

Figure S7: Frequency dependence of EM parameters for mortar (30%WIP+2%CB)/paraffin composites with different EP content (samples 72-80, Data identification is unified).

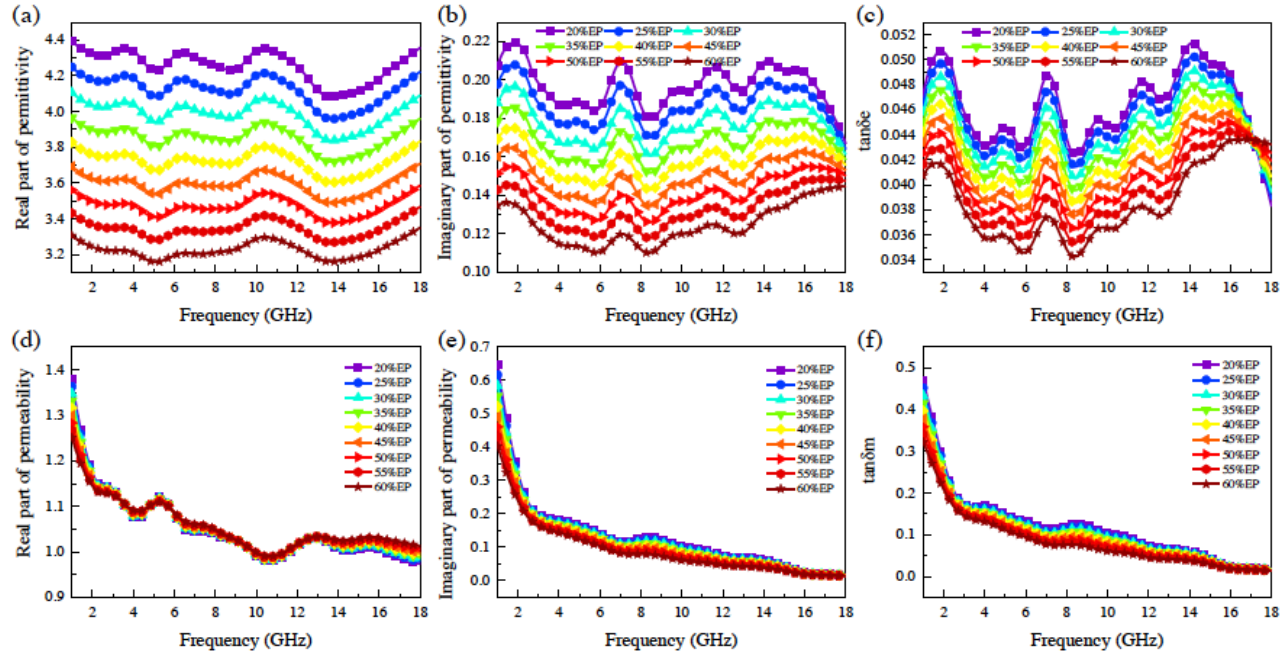

Figure S8: Frequency dependence of EM parameters for mortar (50%WIP+2%CB)/paraffin composites with different EP content (samples 82-90, Data identification is unified).

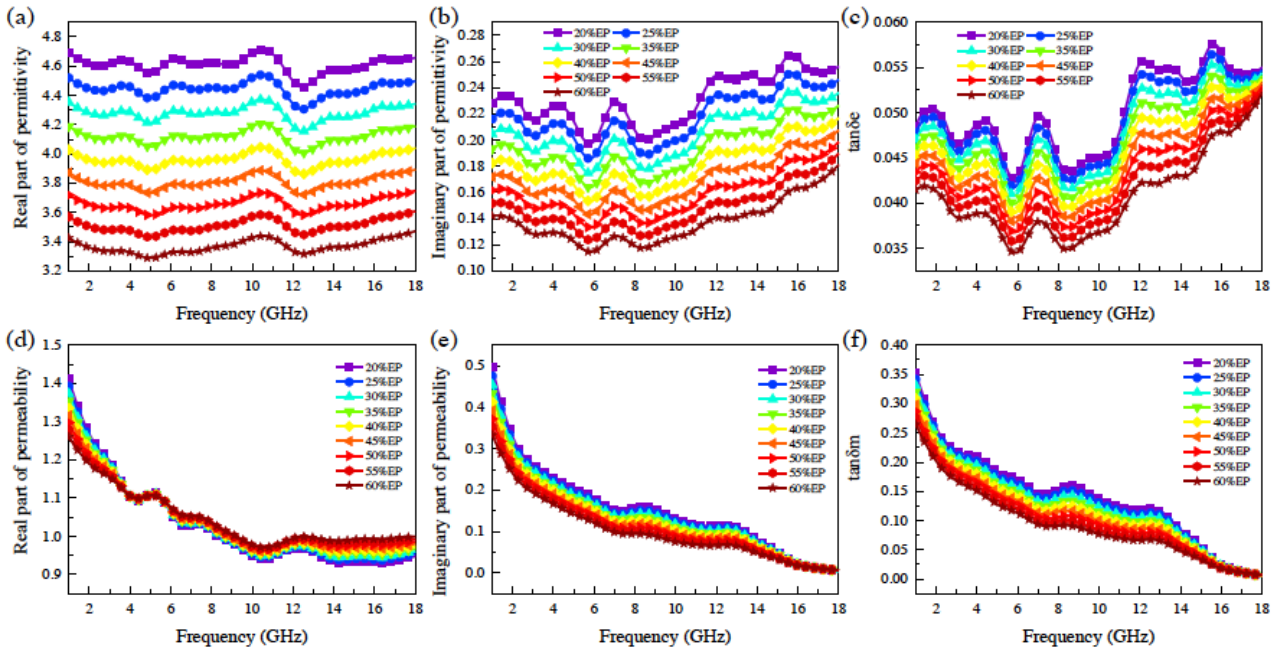

Figure S9: Frequency dependence of EM parameters for mortar (70%WIP+2%CB)/paraffin composites with different EP content (samples 92-100, Data identification is unified).

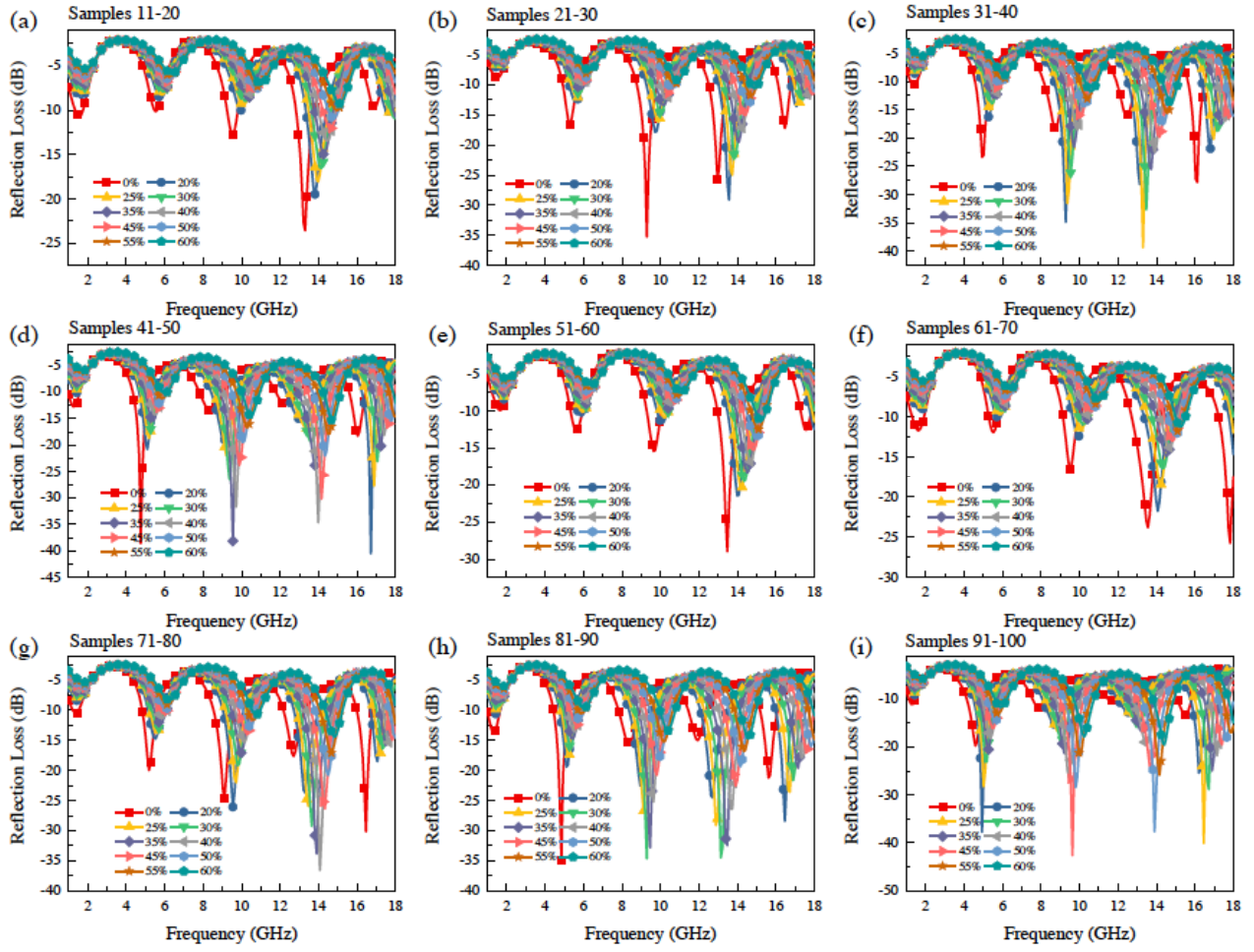

Figure S10: The reflection loss of single layer samples 11-100 with a 20 mm thickness at different EP content.

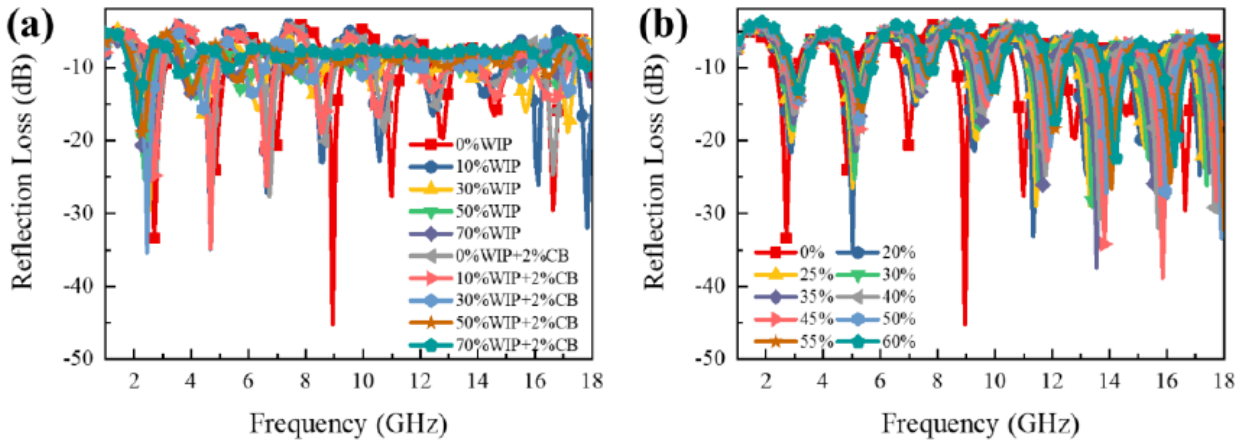

Figure S11: The RL of single layer EM wave absorption material with a 40 mm thickness. (a) The mortar with different WIP and CB, (b) the mortar containing 0%WIP with different volume content of EP.

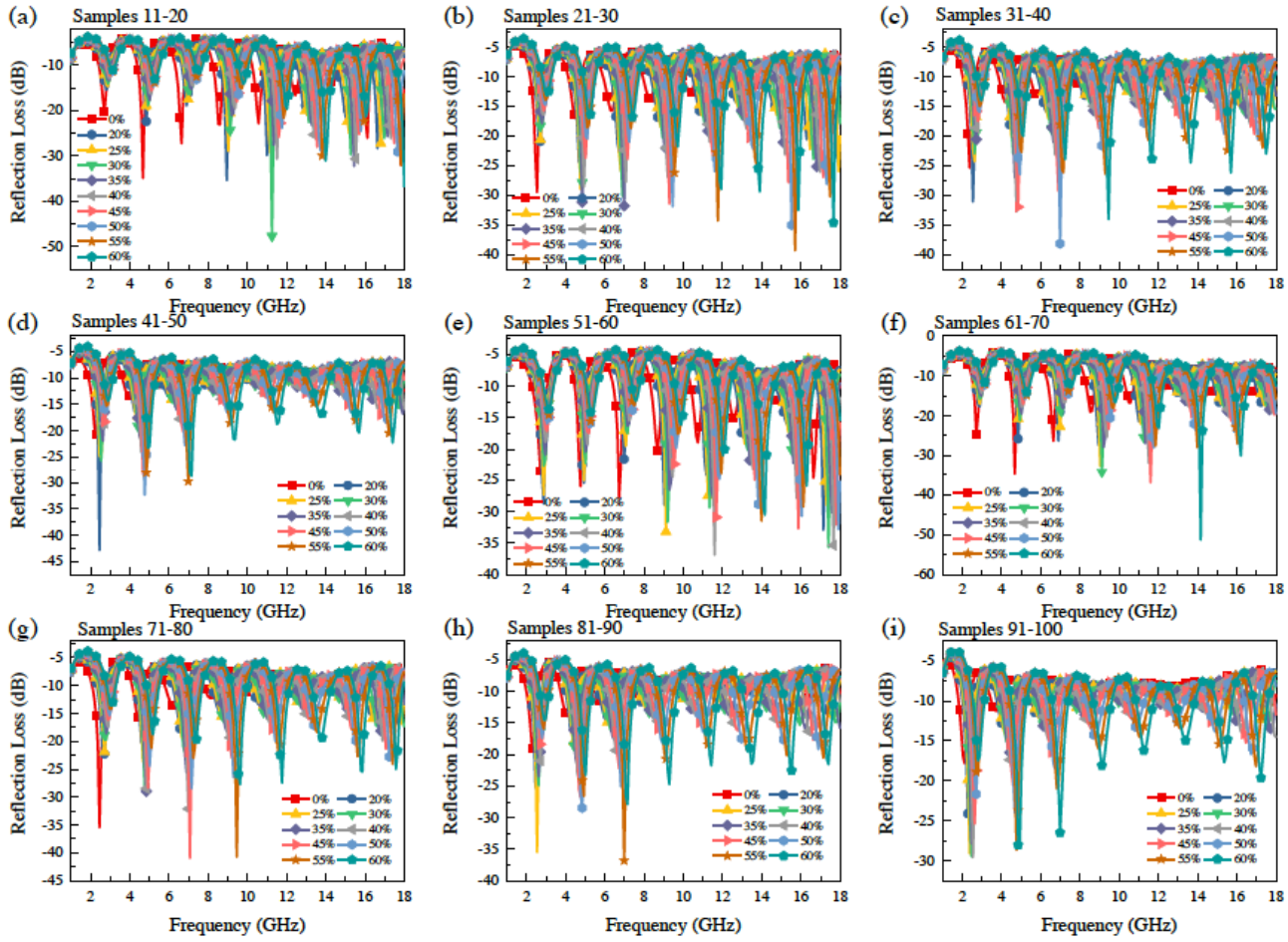

Figure S12: The reflection loss of single layer samples 11-100 with a 40 mm thickness at different EP content.

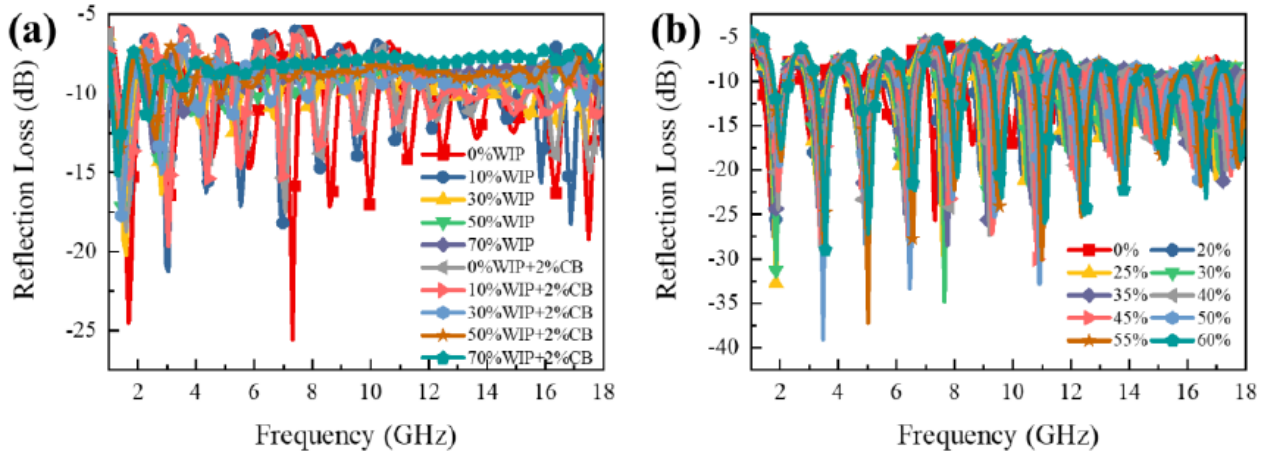

Figure S13: The RL of single layer EM wave absorption material with a 60 mm thickness. (a) The mortar with different WIP and CB, (b) the mortar containing 0%WIP with different volume content of EP.

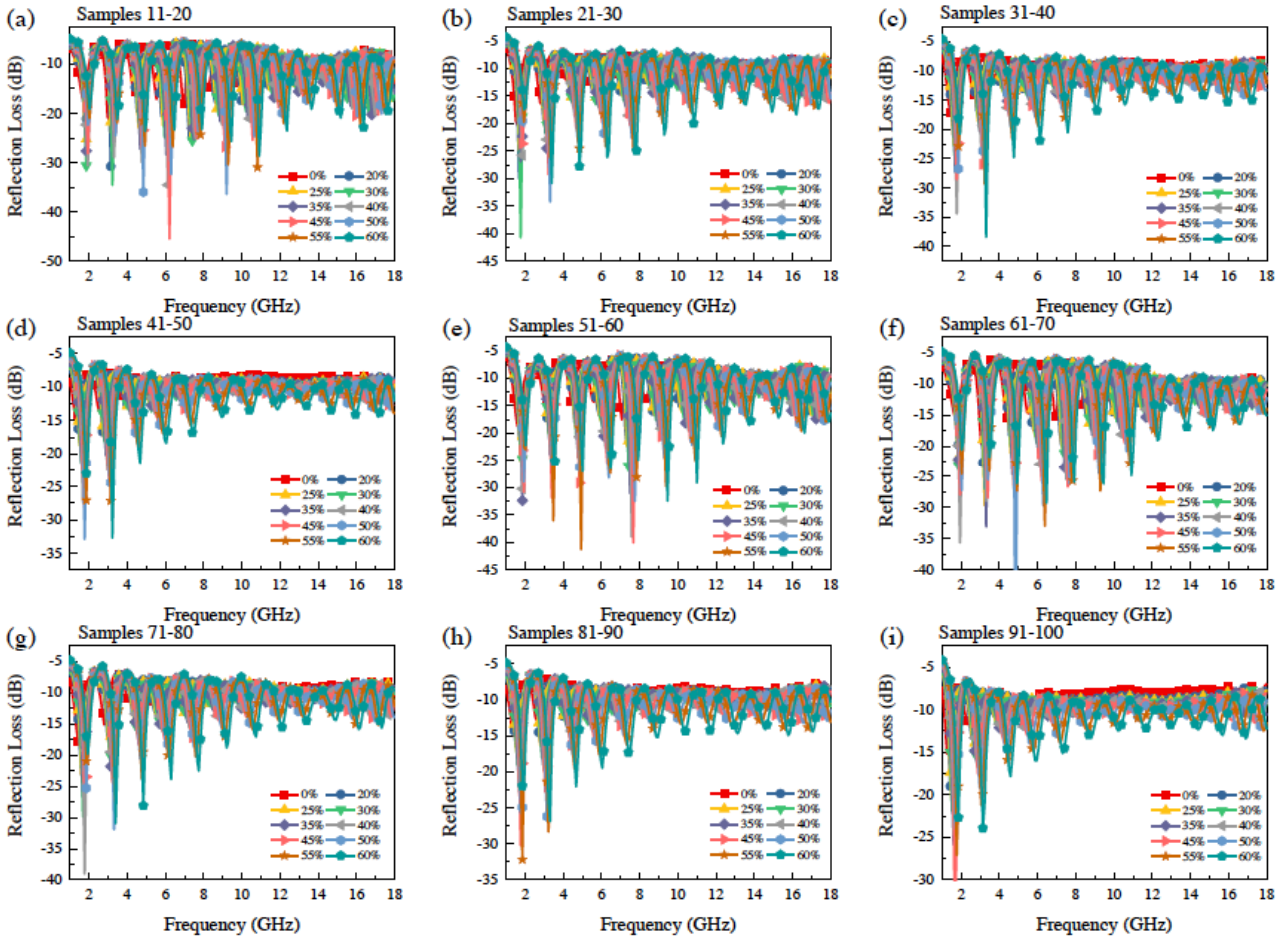

Figure S14: The reflection loss of single layer samples 11-100 with a 60 mm thickness at different EP content.