

# Development of Microwave Curing Technique for Manufacturing Low-carbon Concretes

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## Introduction

One drawback of the manufacture of conventional concrete is the large amount of carbon footprint. To avoid this advantage, pulverised fly ash (PFA) can be used to replace part of cement. However, this method leads to the decreasing of early strength of concrete, which can be solved by curing at microwave circumstance.



Manufacture of concrete



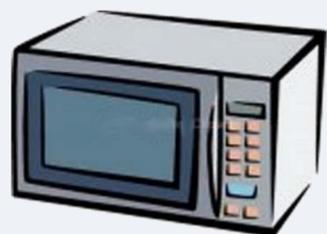
Large amount of carbon footprint



Low early strength

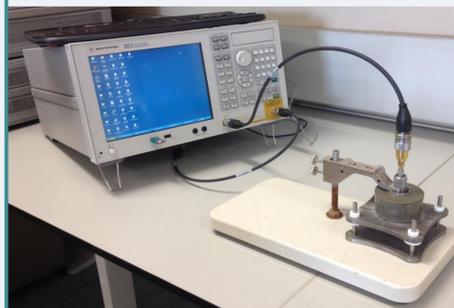


PFA Replacement

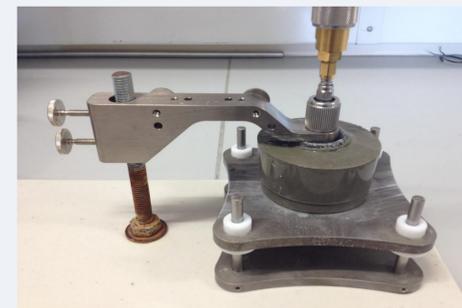


Microwave curing method

## Experiment



Open-ended probe technique



Sample under the probe

## Results & Discussion

Fig. 1 Relative dielectric constant/loss factor for a mortar with different sand sizes at a temperature of 25°C, with 0% PFA and at a frequency of 0.896GHz

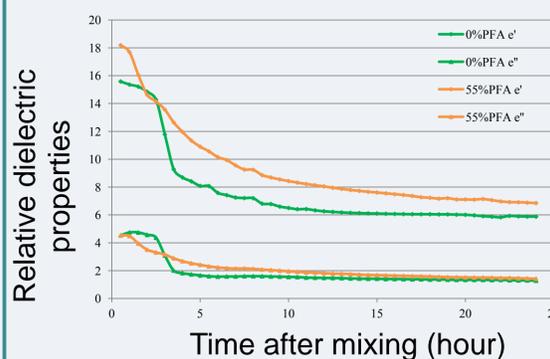
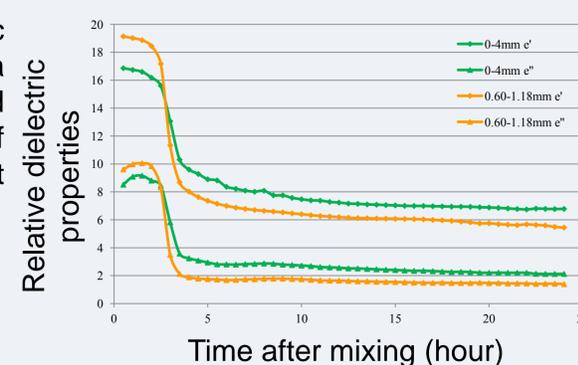


Fig. 2 Relative dielectric constant/loss factor for a mortar with different PFA replacement at an ambient temperature of 25°C, with sand size of 0-4mm and at a frequency of 2.45GHz

Figure 1 shows that the mortar with wider range of sand particle sizes has higher values of dielectric properties except at the early age. It means that more energy will be absorbed and transferred. Figure 2 illustrates that the PFA replacement can enhance the energy absorbed by mortar.

## Aims & Objectives

**Aim:** Develop the manufacture of low-carbon concrete with microwave curing technique.

**Objectives:**

- Study the effect of sand sizes on the dielectric properties of mortar.
- Study other factors that influence the dielectric properties of mortar.

## Conclusion

- The mortar produced by using the sands with relative bigger sizes and much wider size range has a stronger ability to absorb and converse the microwave energy.
- There are other factors that can influence the dielectric properties of mortar, such as the PFA replacement, frequency of microwave and temperature.

### References

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2. Gorur, K., Smit, M. K. & Wittmann, F. H. (1982). Microwave study of hydrating cement paste at early age. *Cement and Concrete Research*, 12,447-454.
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