Acid-treated carbon nanotubes and their effects on mortar strength

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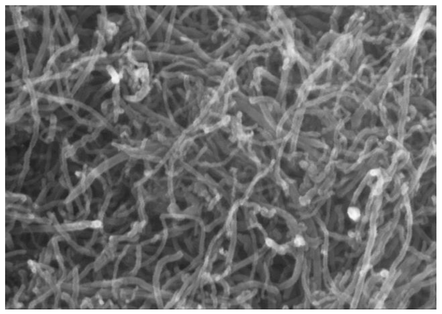
Background

Dispersion of Carbon nanotubes (CNTs) in mortar is a challenging task as they tend to agglomerate forming clusters.



SEM image of entangled CNTs

To improve dispersion:

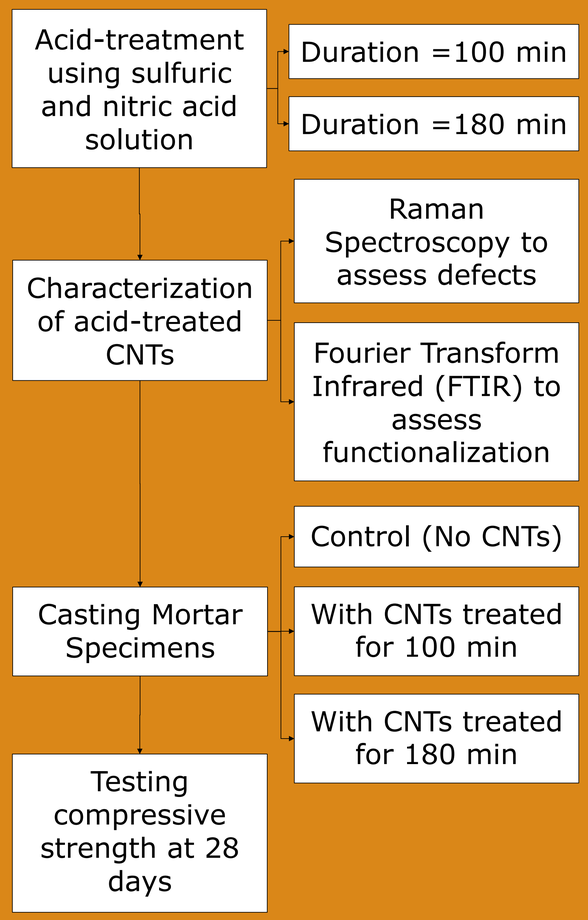
a) Dispersion agents, e.g. surfactants. Main disadvantage is introduction of air voids.

b) Acid-treatment of CNTs in order to introduce functional groups onto the walls of CNTs, a process called functionalization. Main disadvantage is excessive treatment degrade the CNTs.

Research Questions

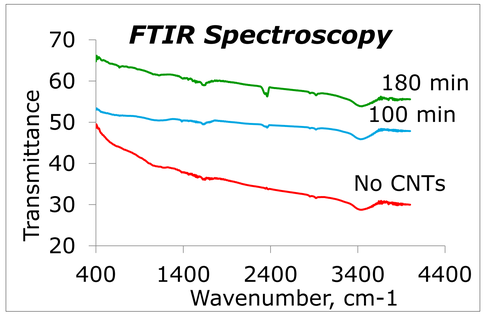
- What is the effect of treatment duration on the degree of defects in CNTs?
- How much improvement in dispersion is achieved with more treatment duration?
- What is the overall effect of treatment duration on the performance of CNTs in mortar?

Methodology

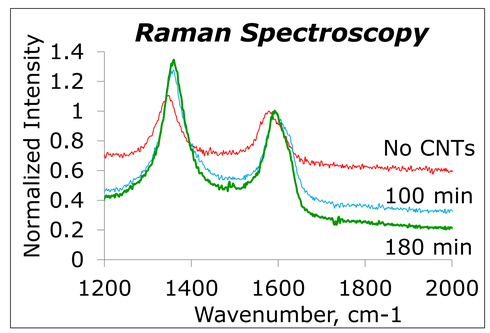


Acid-treatment of CNTs

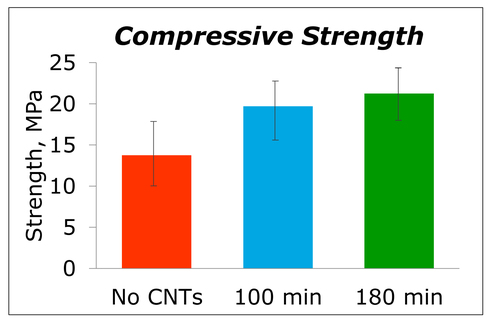
Results and Discussion



- Peak-intensity at 2400 cm-1 increases with treatment denoting effective functionalization



- An increase in the intensity at 1350 cm-1 marks more defects with treatment



- Mortar strength increases with acid-treatment time

Conclusions

The main findings of the study are:

- Defects on CNT produced by acid treatment were evidenced by FTIR Spectra.
- Strength of mortar containing CNTs treated with the acidic solution increased by 40% as compared with the mortar without CNTs.
- Increase in treatment duration from 100 min to 180 min slightly enhanced mortar strength, resulting from improved CNT dispersion.

Recommendations

A comprehensive study needs to be performed to investigate the effect of a wide range of treatment durations, possibly leading to an optimum treatment duration. A set of other factors like temperature, acid type and acid molarity could also be considered.

References

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