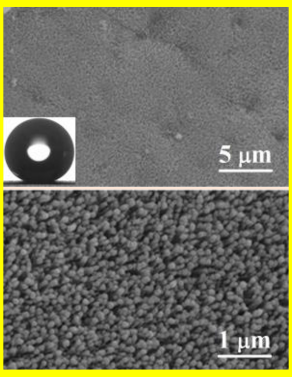
Enhanced condensation heat transfer in air-conditioner heat exchanger using superhydrophobic foils

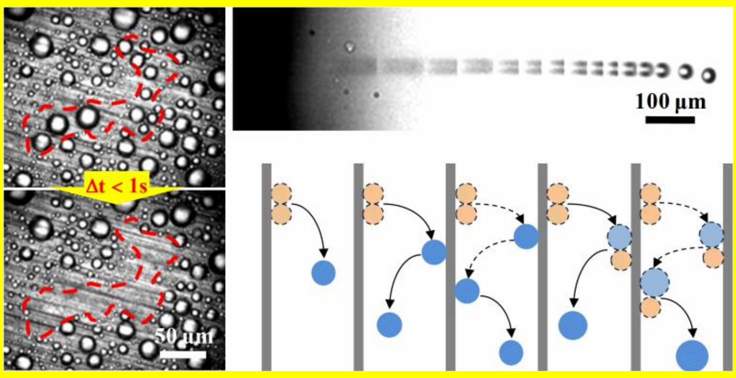
Abstract we fabricated a novel air-conditioner fin-tube heat exchanger with superhydrophobic foils, which showed high performance in self-cleaning, anti-condensation, anti-frosting, anti-corrosion and environment stability, promising a good candidate for improving energy efficiency of air-conditioners in future. Enhanced condensation heat transfer were demonstrate on indoor and outdoor condenser in summer and winter, respectively.

Results and Discussion

FESEM

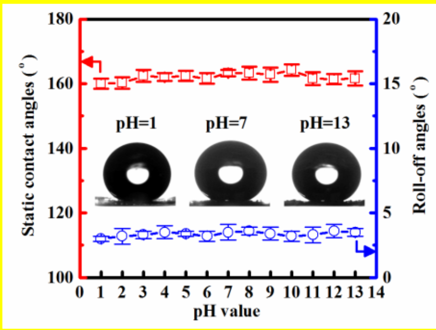


Condensation

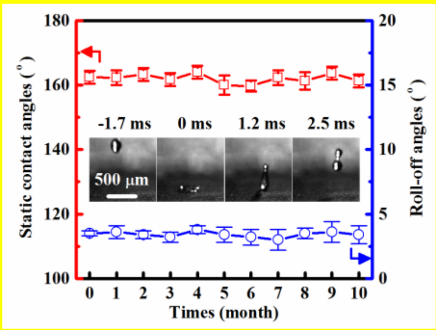


Defrosting

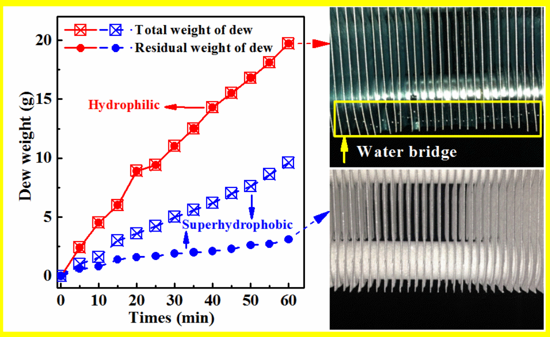
Anti-corrosion



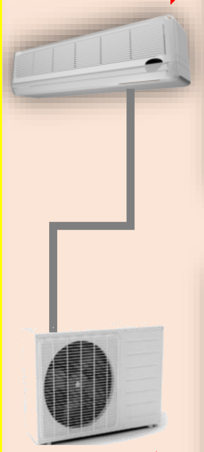
Environment stability



Anti-dewing

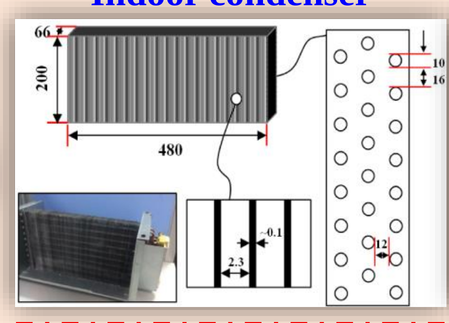


In summer

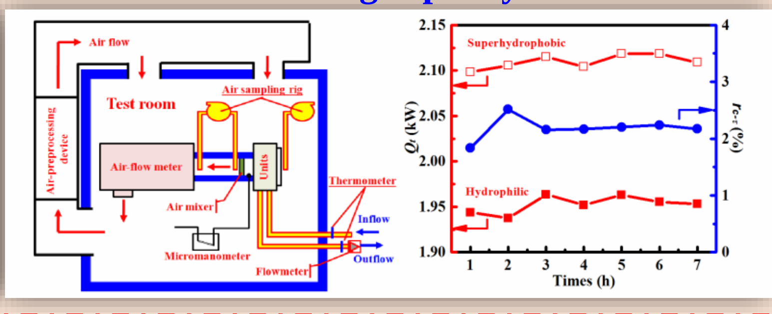


In winter

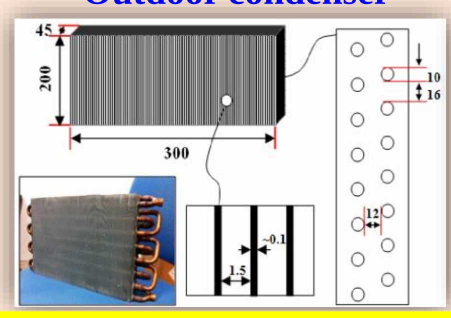
Indoor condenser



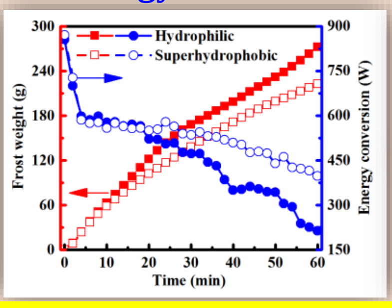
Cooling capacity



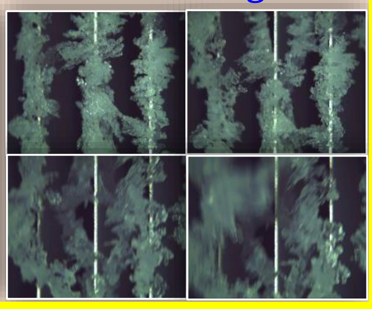
Outdoor condenser



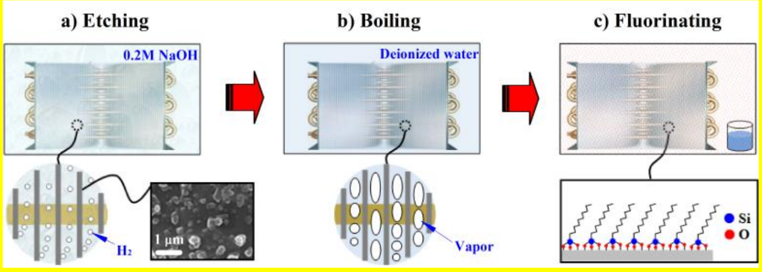
Energy conversion



Defrosting



Methods



Conclusion

We developed a facile process to fabricate superhydrophobic heat exchanger, which promises a good candidate for enhancing HT efficiency of air-conditioners. The continuously jumping behaviors of dewdrops could be maintaining that the residual dew weight on hydrophilic heat exchanger is quintuple on the hydrophilic one after 1 hour. Over 8 and 2 percent of the cooling capacity and HT coefficient were additionally obtained on the superhydrophobic exchanger compared with conventional hydrophilic one under the rated output working conditions. In winter, the ratio of frost weight and corresponding energy conversion between in hydrophilic and superhydrophobic exchangers are about 1.22 and 0.54 after 60 min. These suggest that the superhydrophobic aluminum-foils not only enhance the CHT efficiency of heat exchanger, but also prolong its service life due to the potential of self-clean, anti-mildew and anti-corrosion.

References

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