Poly(urea-formaldehyde) microcapsules for self-lubricating applications

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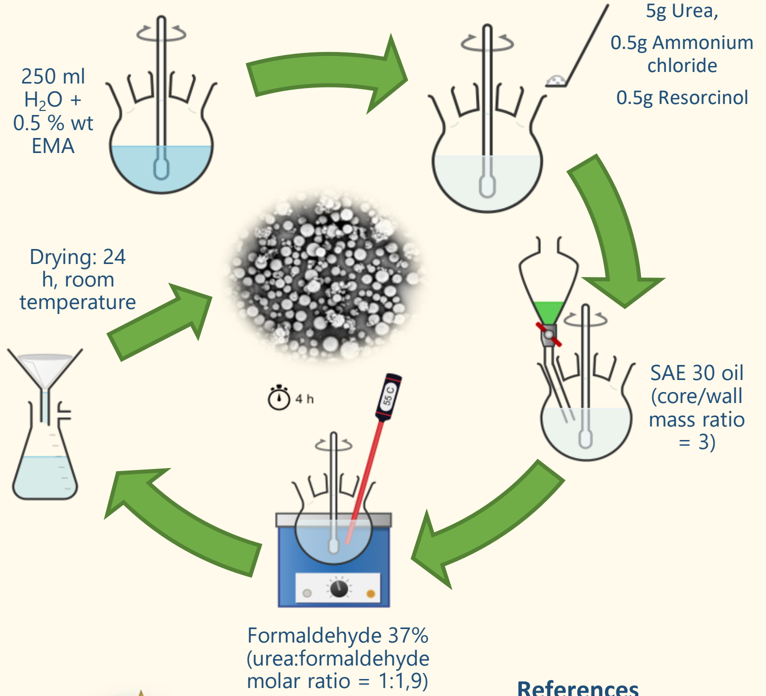
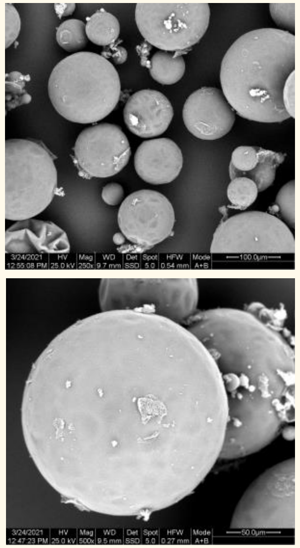
Introduction

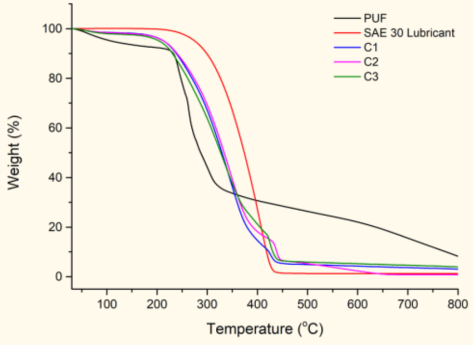
Moving parts of all mechanical systems need to be lubricated for the efficient operation of the system. The effectiveness and stability of lubrication are crucial for improving reliability and lifetime of manufactured products, also reducing wastes of natural resources and energy. Introducing microcapsules containing lubricant into the surface of moving parts, significantly improves anti-friction properties and wear resistance. When the surface is subjected to friction, the microcapsules are ruptured and the encapsulated lubricants are released onto the surface, forming a boundary lubrication film that significantly reduces the friction coefficient and wear rate. The aim of the current work is to produce poly(urea-formaldehyde) microcapsules with an encapsulated lubricating oil to be used in metal coating produced *via* thermal spraying. Within the current study the stirring rate during *in situ* polymerization was examined in respect to the microcapsules characteristics.





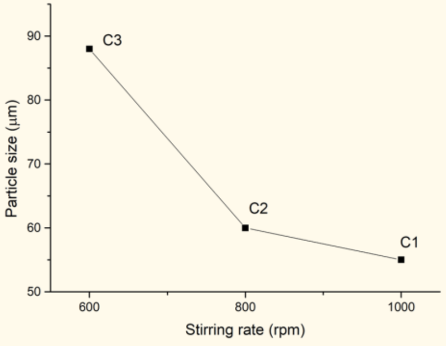
SEM images of sample C1

Sample	Stirring rate (rpm)	Encapsulation Efficiency (%)	Particle Size (μm)
C1	1000	79	55
C2	800	76	60
C3	600	80	88

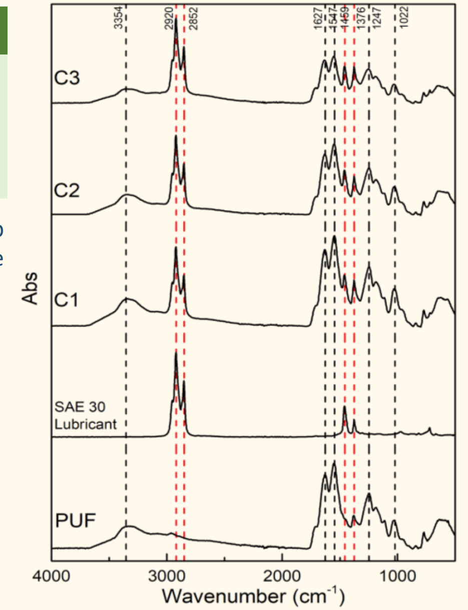


TGA curves of reference materials and microcapsules

TGA suggests thermally stable microcapsules, up to 215 °C with no significant dependence of the thermal properties on the stirring rate.



Particle size vs stirring rate



FTIR spectra of reference materials and microcapsules

Black: peaks corresponding to PUF

Red: peaks corresponding to lubricant

References

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Conclusions

Lubricating oil was successfully encapsulated within a poly(urea-formaldehyde) shell using *in-situ* polymerization. Within the current work the stirring rate during encapsulation was studied. The results evidence that reducing the rate of agitation affects mainly the particle size, which is increased. On the other hand, the encapsulation efficiency, thermal properties and chemical structure do not present any significant variation.