Dual functionalized copper nanoparticles for thermoplastics with improved processing, mechanical properties and superior antibacterial performance

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1. Experimental

1.1. MIC and MBC [S1]

A concentration gradient of the sample and liquid medium mixture was prepared using the pairwise dilution method, consisting of a series of concentration gradients ranging from 0 to 40 mg/mL. 0.02 mL of bacterial suspension with a concentration of 10^8 CFU/mL was injected into each tube with a micropipette, shaken well, and incubated at 37 ^oC for 24 h. The turbidity of the solution in each tube was observed and the concentration at which the solution began to appear clarified was recorded as the MIC value of the antimicrobial agent. The experiment results were observed visually. And the lowest concentration that inhibited growth with less than 5 colonies or no colony was determined as the MBC value of the sample.

2. Results and Discussion

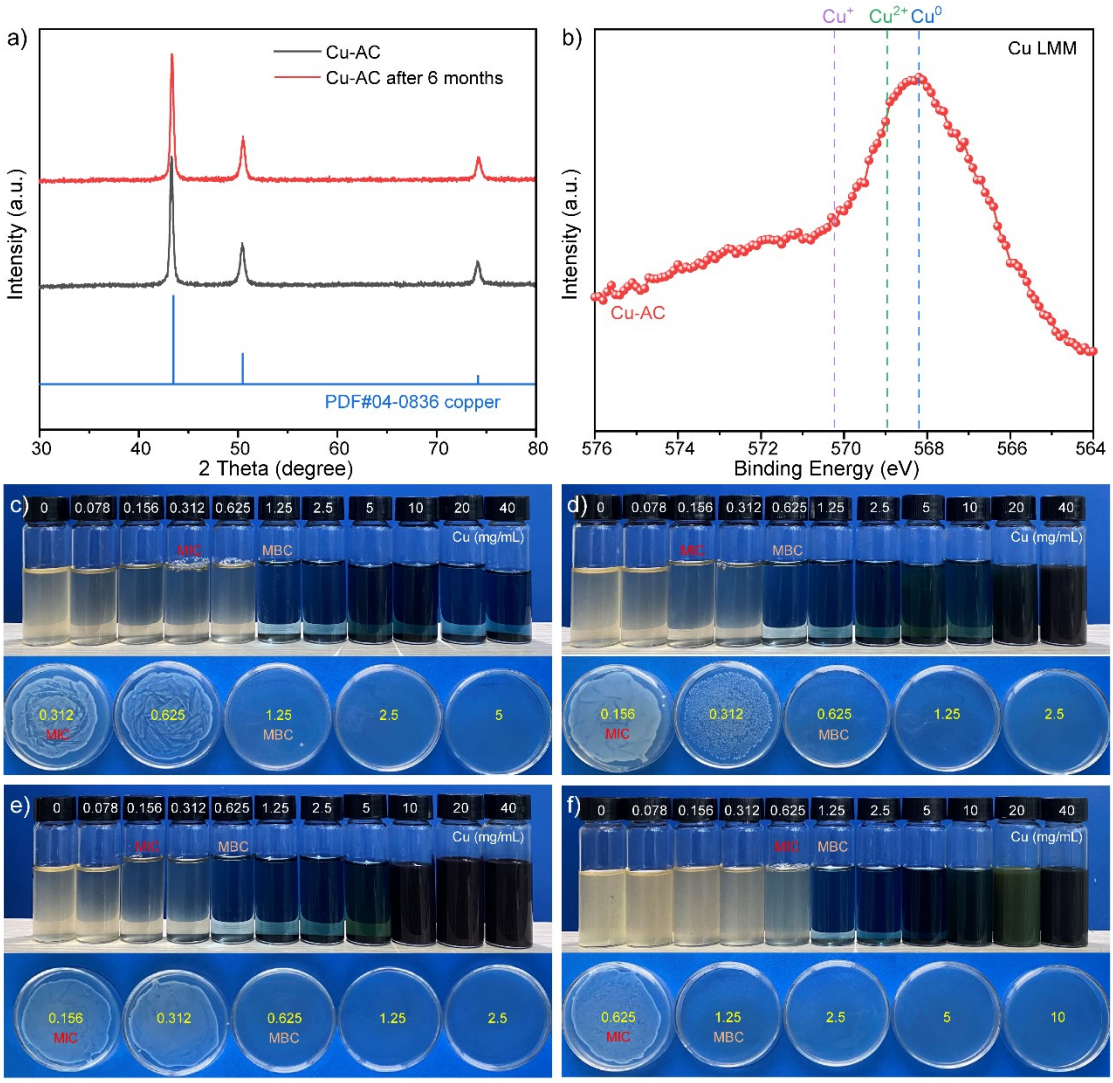

Fig. S1 a) X-ray diffraction patterns of Cu-AC with varied storage periods; b) XPS spectrum of the Cu LMM for Cu-AC nanoparticles. Optical photographs of E. coli cultures with copper nanoparticles of different particle sizes and concentration gradients: c) 150 nm; d) 80 nm; e) 50 nm; f) 30 nm.

The results of Fig. S1c-f showed that Cu-AC in the range of 50-80 nm exhibited optimal antimicrobial properties. Its MIC and MBC values were 0.156 and 0.625 mg/mL, respectively.

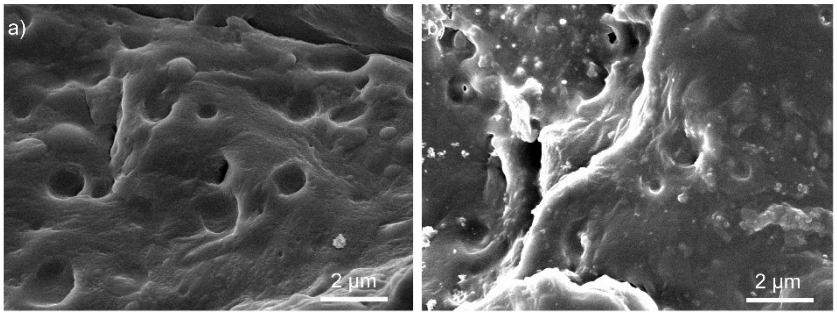

Fig. S2 SEM images of brittle sections of PP (a) and PP/Cu (b) masterbatch.

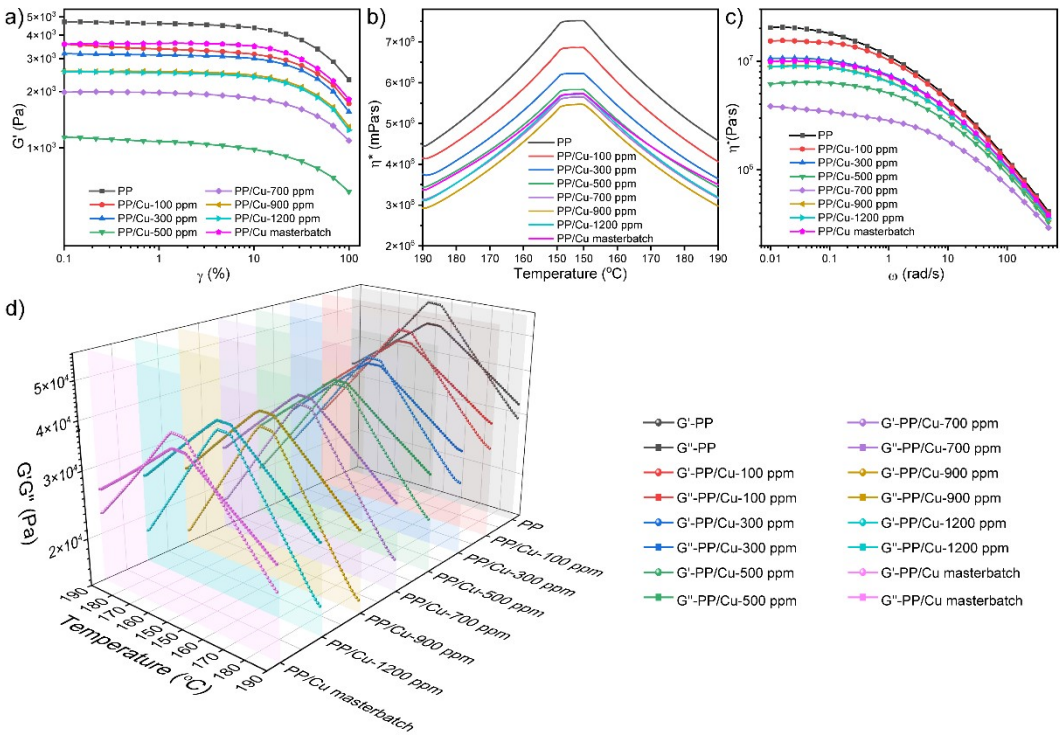

Fig. S3 Rheological performance of PP and PP/Cu composites. a) Variation curves of modulus with strain in strain scan mode; b) variation curves of complex viscosity with temperature in temperature scan mode; c) variation curves of complex viscosity with angular velocity in frequency scan mode; d) variation trend of modulus with temperature in temperature scan mode.

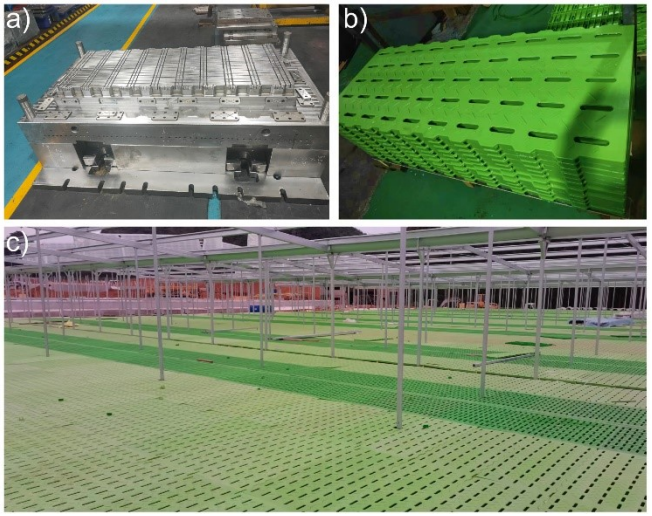

Fig. S4 Digital photos of a) molding die for dung leaking boards; b) PP/Cu dung leaking boards; c) application of PP/Cu dung leaking boards.

Reference

[S1] SB. Chudasama, A. K. Vala, N. Andhariya, R. V. Upadhyay and R. V. Mehta, *Nano Research*, 2010, **2**, 955-965.