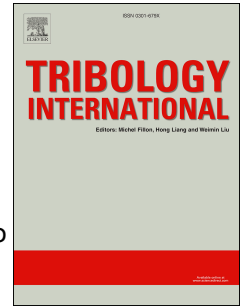


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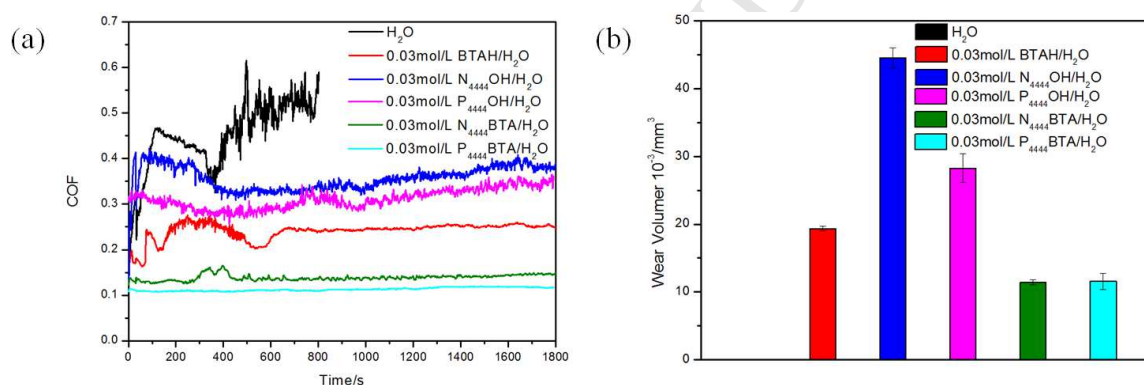
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## Graphic abstract

# In situ preparation of multifunctional additives in water

Mingjin Fan <sup>a,\*</sup>, Xin Du <sup>a</sup>, Lin Ma <sup>a</sup>, Ping Wen <sup>a</sup>, Shuai Zhang <sup>a</sup>, Rui Dong <sup>a</sup>, Wenjing Sun <sup>a</sup>,  
Desuo Yang <sup>a,\*</sup>, Feng Zhou <sup>b</sup>, Weimin Liu <sup>b</sup>

Water-based lubricating additives P<sub>4444</sub>BTA and N<sub>4444</sub>BTA were prepared in situ in aqueous solution. The additives were found not only easy to be prepared, but also have excellent tribological properties. In addition to their significant tribological properties, these additives also show excellent corrosion resistant ability, which makes them multifunctional additives for water based lubricants.



Evolution of the friction coefficients (a) and wear volume losses(b) for different samples on copper/steel friction pairs.

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