AFM nanotribology study of the frictional properties of hydroxyquinolines isomers and ethanolamine oligomers

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Hydroxyquinolines are bicyclic hetero-aromatic compounds of the total formula C_9H_7NO. They are not soluble in water, and are utilised as lubricant additives. Ethanolamines are miscible with water and so utilised as lubricating additives in cooling water.

Experiments at the macro- to the nanoscale show that different isomers of hydroxyquinoline have different lubrication properties on tribologically relevant surfaces, e.g. 100Cr6 steel or copper [1]. Understanding of the lubrication properties of the first chemisorbed layer of these additives on workpieces yields important information regarding lubrication optimisation (concerning type of additive, amount, type of isomer or oligomer).

Chemisorbed layers of 4- and 6-hydroxyquinoline isomers and mono-, di- and triethanolamine were investigated with atomic force microscopy methods regarding differences in their lubrication properties at the nanoscale.

The hydroxyquinolines were dissolved in toluene, the ethanolamines in double distilled water. Copper sputtered silicon wafers served as substrates, these specimens were brought in contact with the model solutions in a closed fluid cell.

First, the friction force values as introduced by Bhushan [2] of the virgin surfaces were determined. Then, the additives were induced into the fluid cell. Concentrations of the additives were significantly below saturation concentration, to prevent the growth of additive crystals on the copper surface.

For 4- and 6- hydroxyquinolines and the virgin copper surface the friction force method yielded distinct differences in the friction force values. First results for the friction force values of mono-, di- and triethanolamine on copper will also be presented.

References:

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