

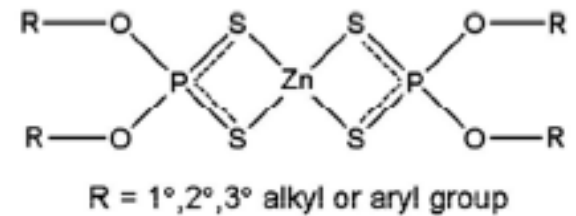
Tribological Behavior and Characterization of Tribofilms Generated From Serpentine

-----X-ray Absorption Spectroscopy
Tribology
Mineral Material

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April 15, 2013

Introduction



ZDDP

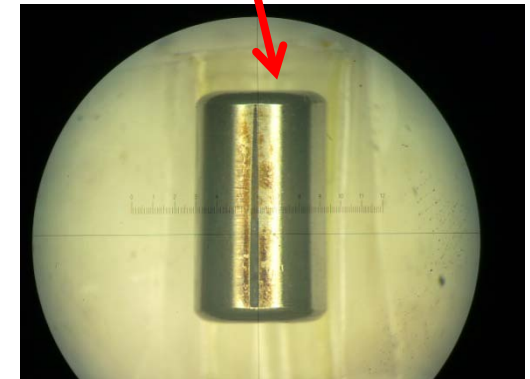
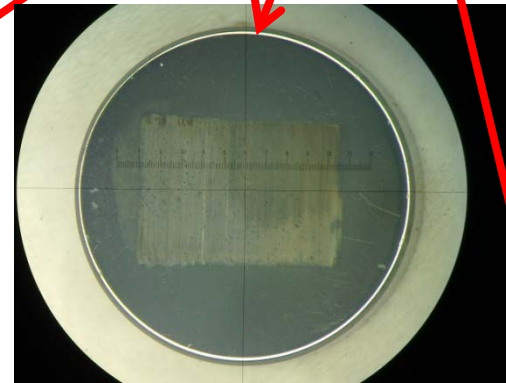
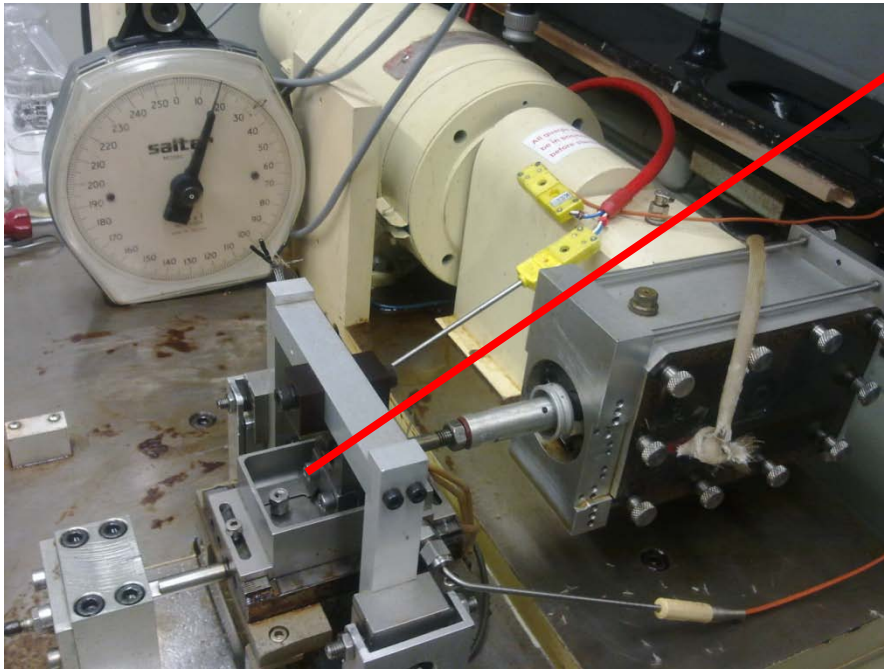
- Automotive components require a variety of lubricating oil additives and fluids to operate satisfactorily.
- Zinc dialkyl dithiophosphates ($\text{ZDDP-Zn}[(\text{S}_2\text{P}(\text{OR})_2)_2]$) has been used in internal combustion engines for many years as an antioxidant and antiwear additive.
- As an environmental protection measure, the use of sulfur- and phosphorus-containing compounds as lubricant additives has been restricted.
- So developing new additives that with little pollution has therefore become the target for researchers.

Material and Method

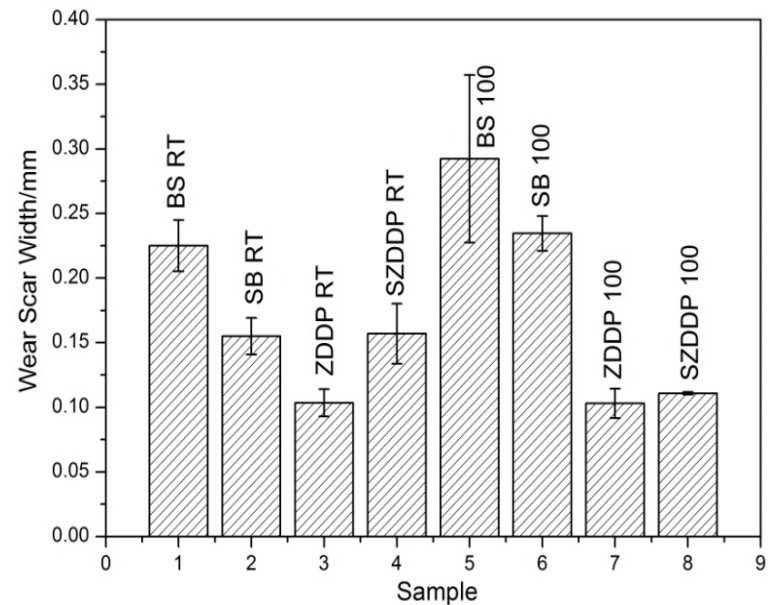
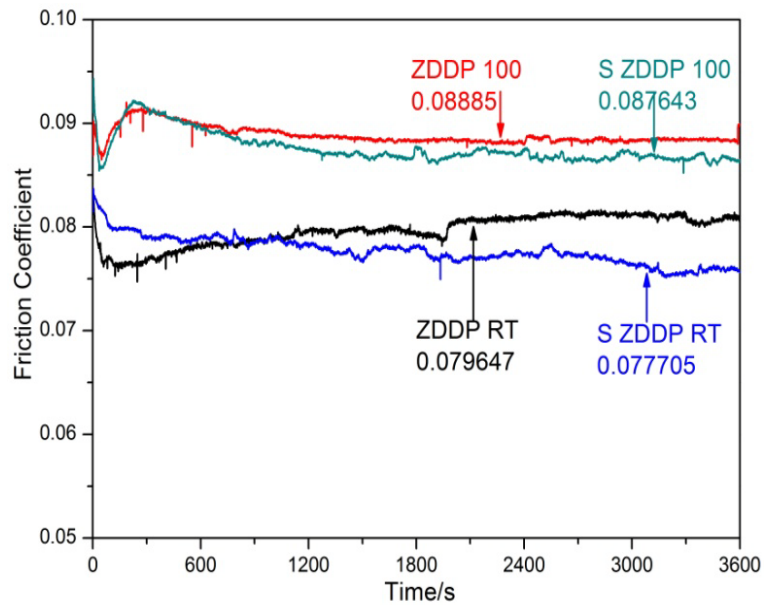
- Recent researches indicate that through the addition of serpentine (layered magnesium phyllosilicate, $Mg_6Si_4O_{10}(OH)_8$) to lubricating oil, the wear resistance ability of the oil was improved and the friction coefficient was decreased.
- Plint high frequency friction machine.
- Scanning electron microscopy (SEM).
- Energy dispersive X-ray spectroscopy (EDX).
- X-ray absorption spectroscopy.

Highlight of Research

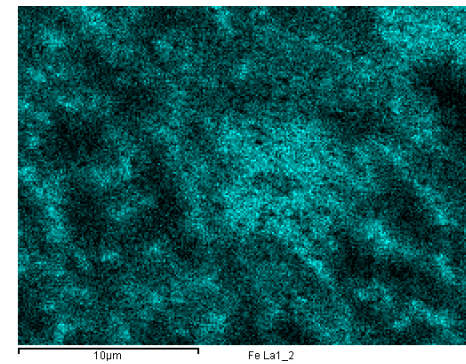
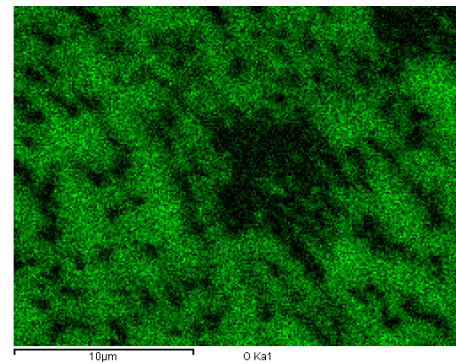
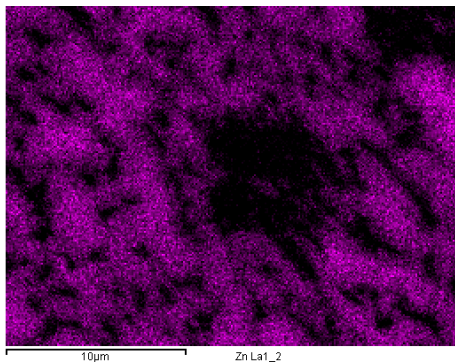
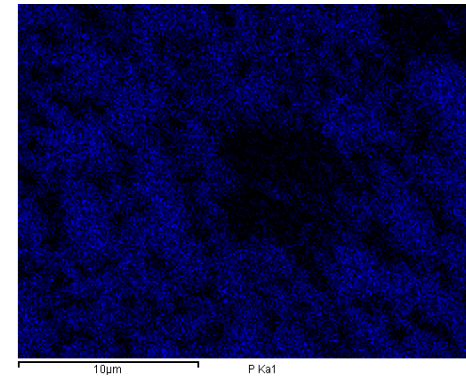
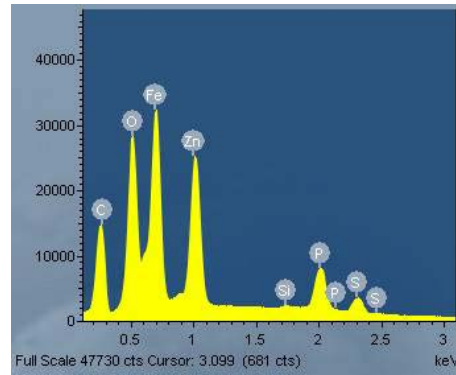
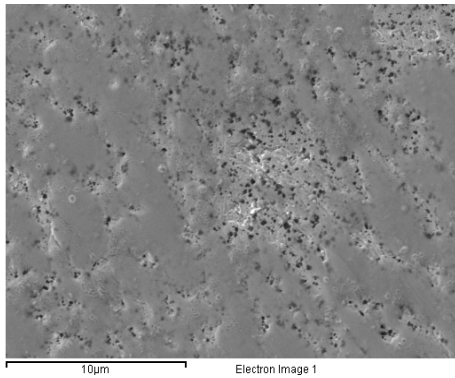
- Tribological performance



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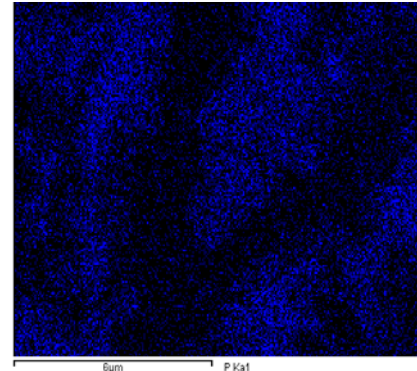
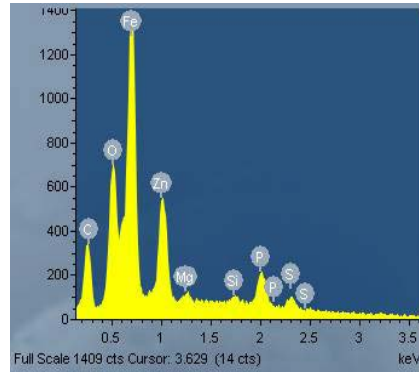
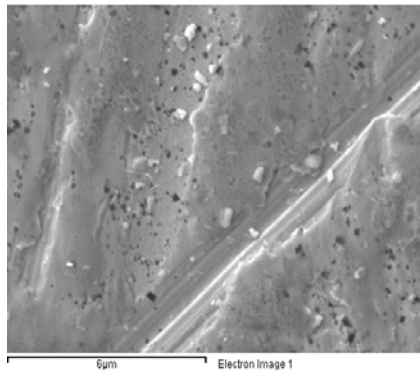


- Morphology and elemental composition of tribofilms

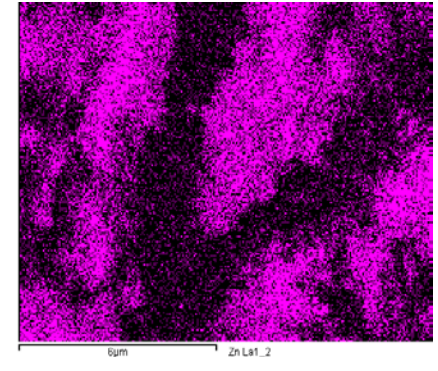


Film formed by ZDDP

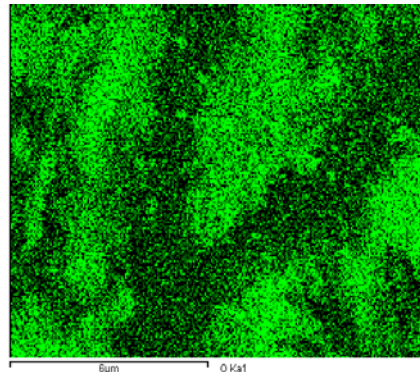
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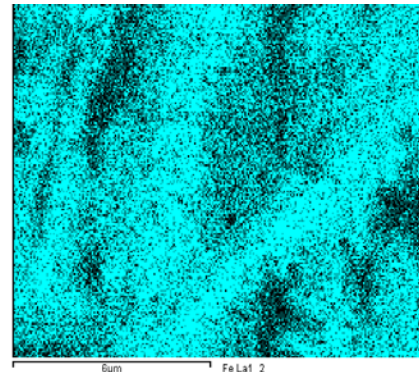
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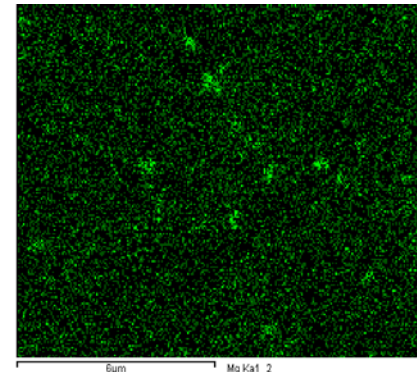
Zn



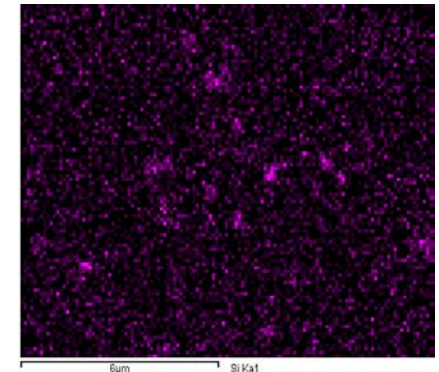
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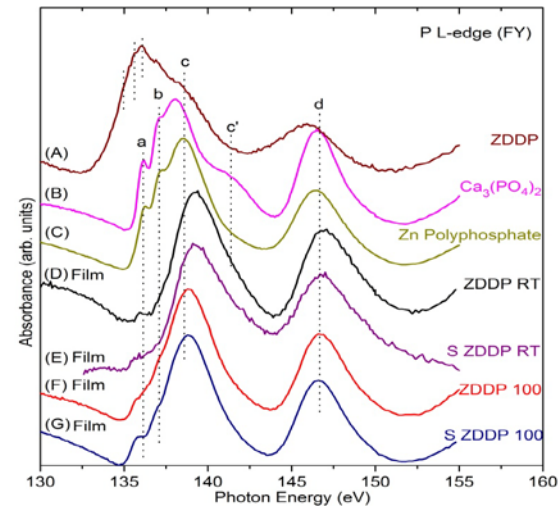
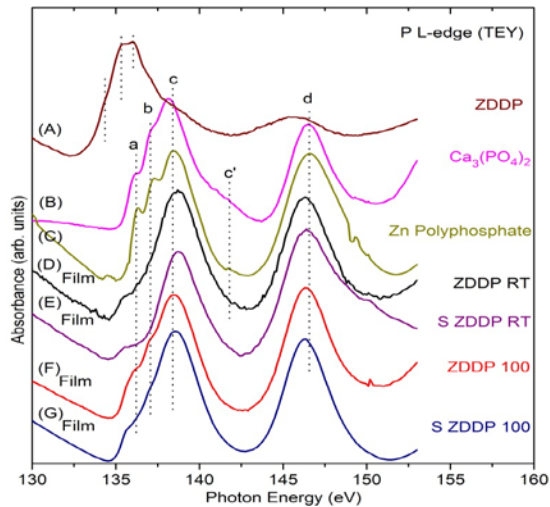
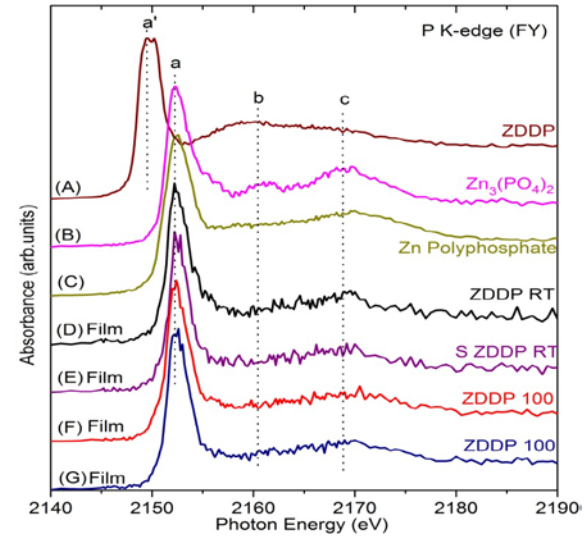
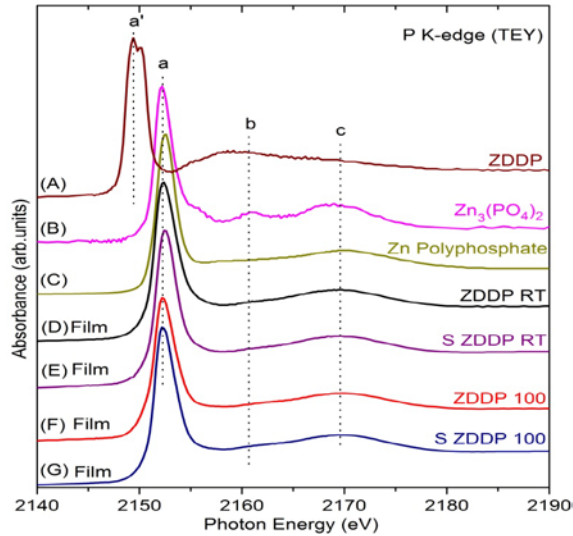
Mg



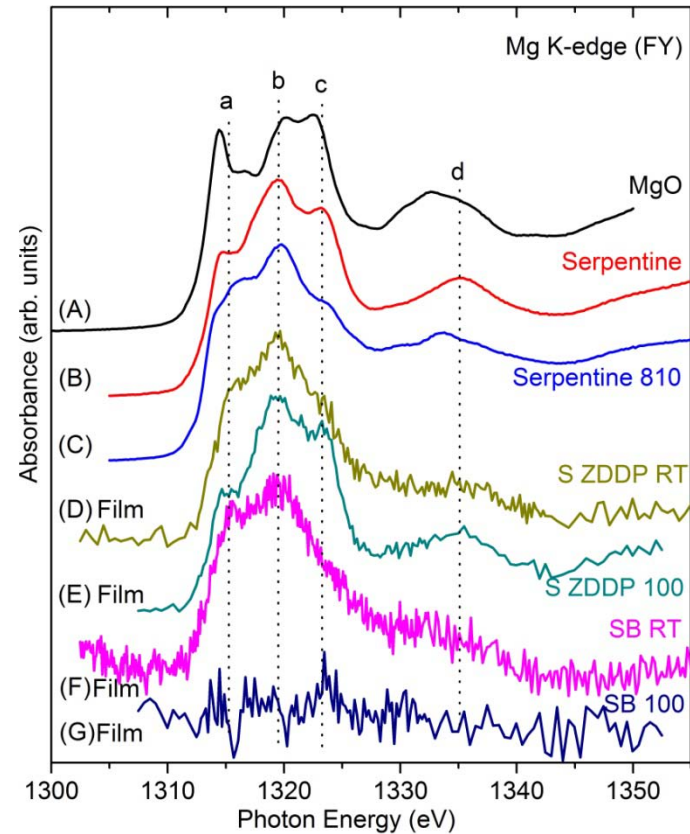
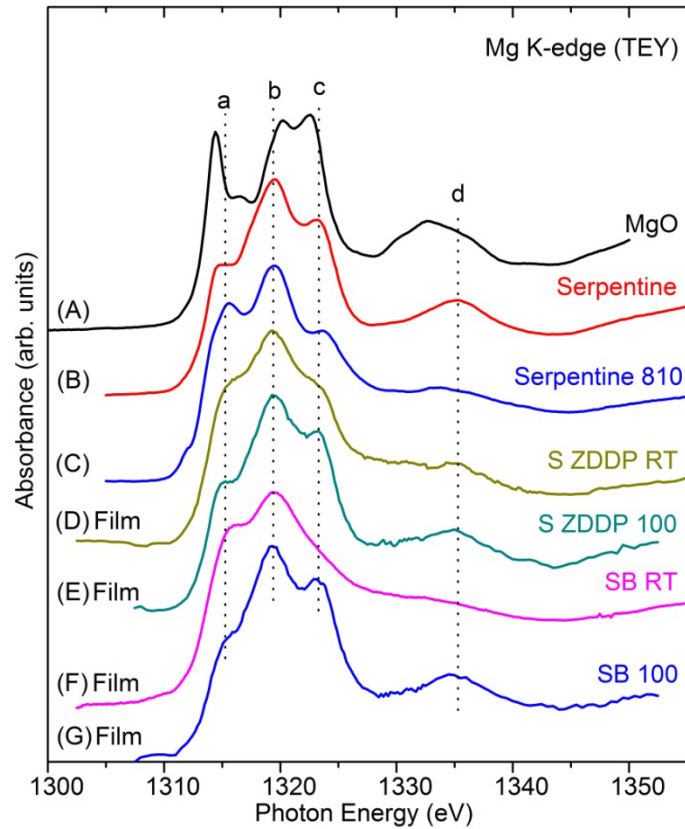
Si

Film formed by ZDDP and serpentine

- X-ray absorption spectroscopy characterization of tribofilms



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Future work

- Atomic force microscopy (AFM)----thickness, morphology
- Different wear test time ----confirm the forming process of the film
- Focused ion beam (FIB)----cross section of the tribofilm to study the structure of the film

Thank you!