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Tribological behavior of CNTs Reinforced AZ31 and Mechanical properties of WS2/AZ91 metal matrix composites

碳纳米管增强AZ31金属基复合材料的摩擦学行为



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Abstract

In this work, WS2 microparticles reinforced AZ91 and AZ31 with CNTs wt% were fabricated using the stir casting. The composites were homogenized and artificially aged. The AZ91/WS2 samples were deformed using equal channel angular pressing(ECAP). Tribological investigations of CNTs/ AZ31 were performed under the block on disc tribometer. The results indicate that the addition of reinforcement reduces the porosity and enhances the strength and hardness of the composites. The constituent phases produced during severe plastic deformation encourage the variation in elastic modulus of the composites. After homogenization, composites are only succeeded for two passes of ECAP. Mechanical properties are linearly proportional to annealed WS2/AZ91 composites. Tribological investigations found that 1wt% CNTs/AZ31 has a minimum coefficient of friction and wear rate. The Mechanical properties are improved with the addition of CNTs and microstructure is refined by a decrease in grain size.

Research Focus

Extracted Results

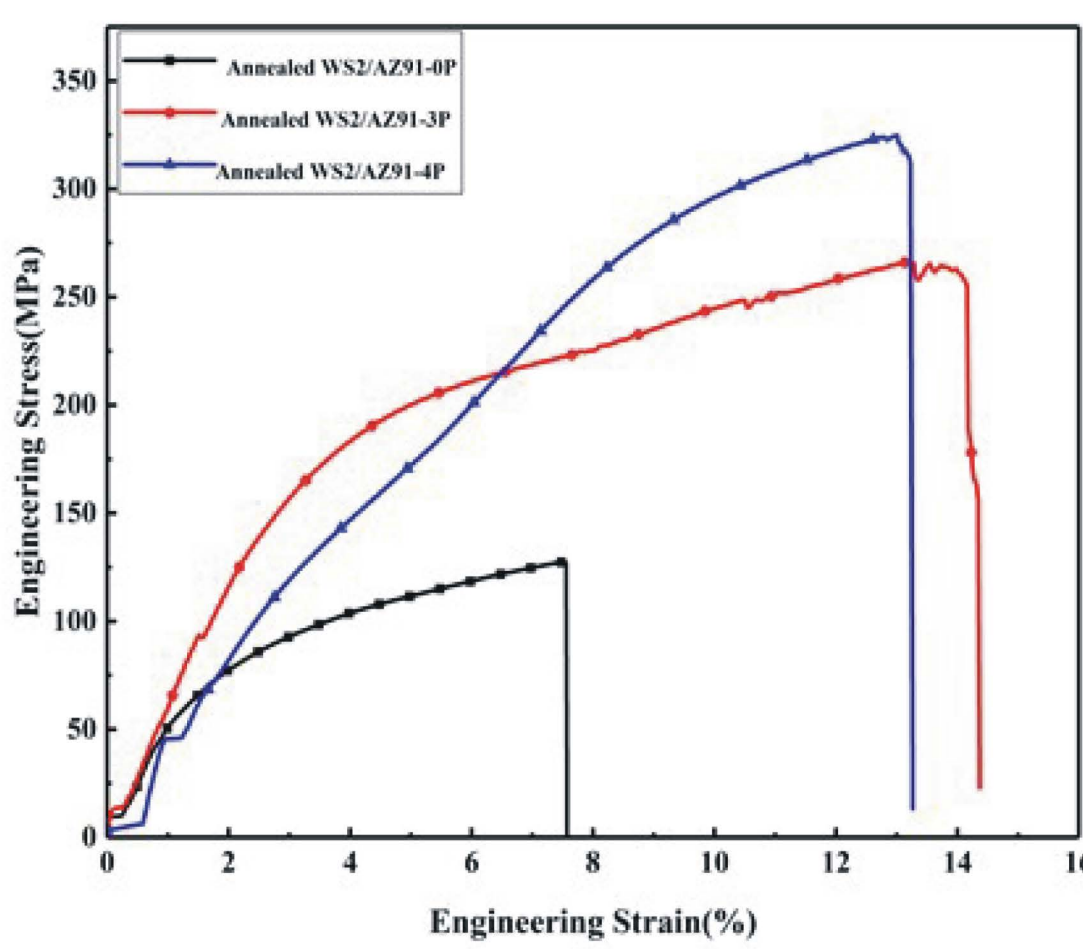


Fig. 1. Stress-Strain relation for annealed 1wt%

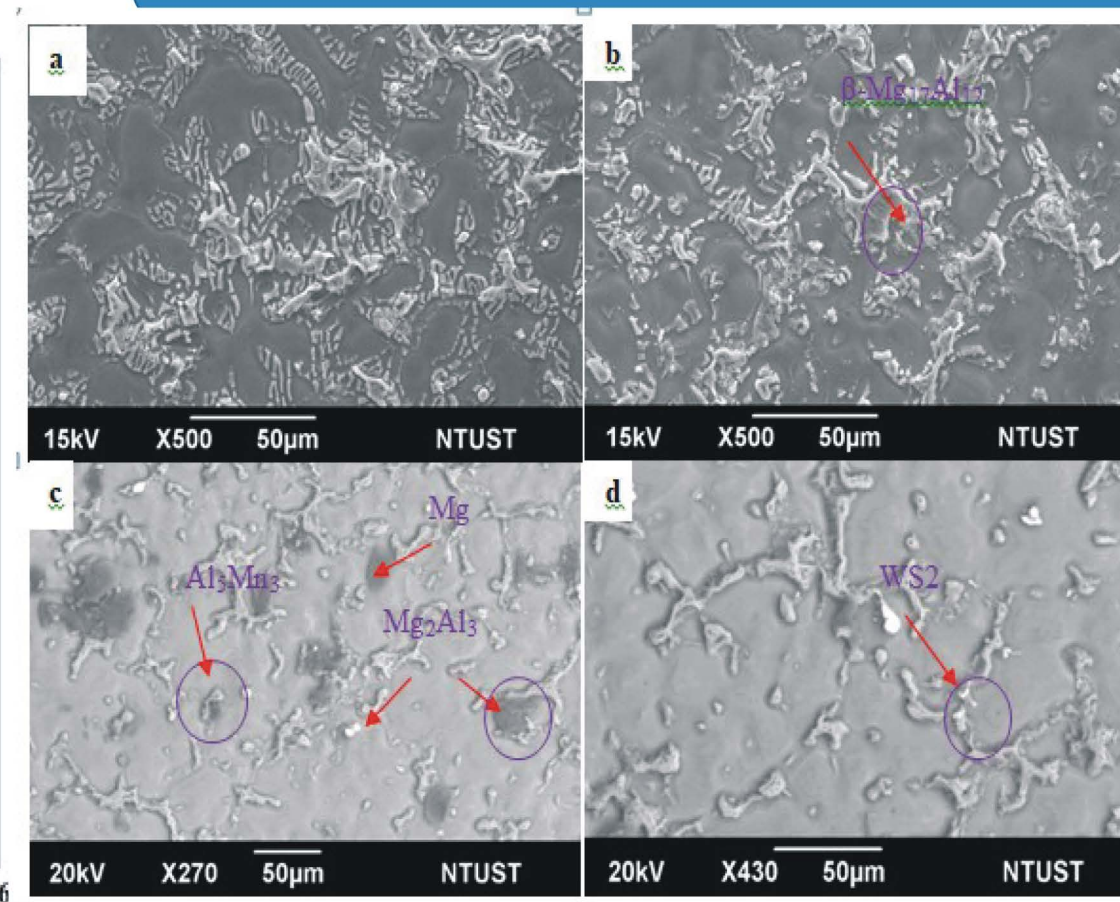


Fig. 2. SEM images of (a) 0wt% (b) 0.3wt% (c) 0.6wt% (d) 1wt%

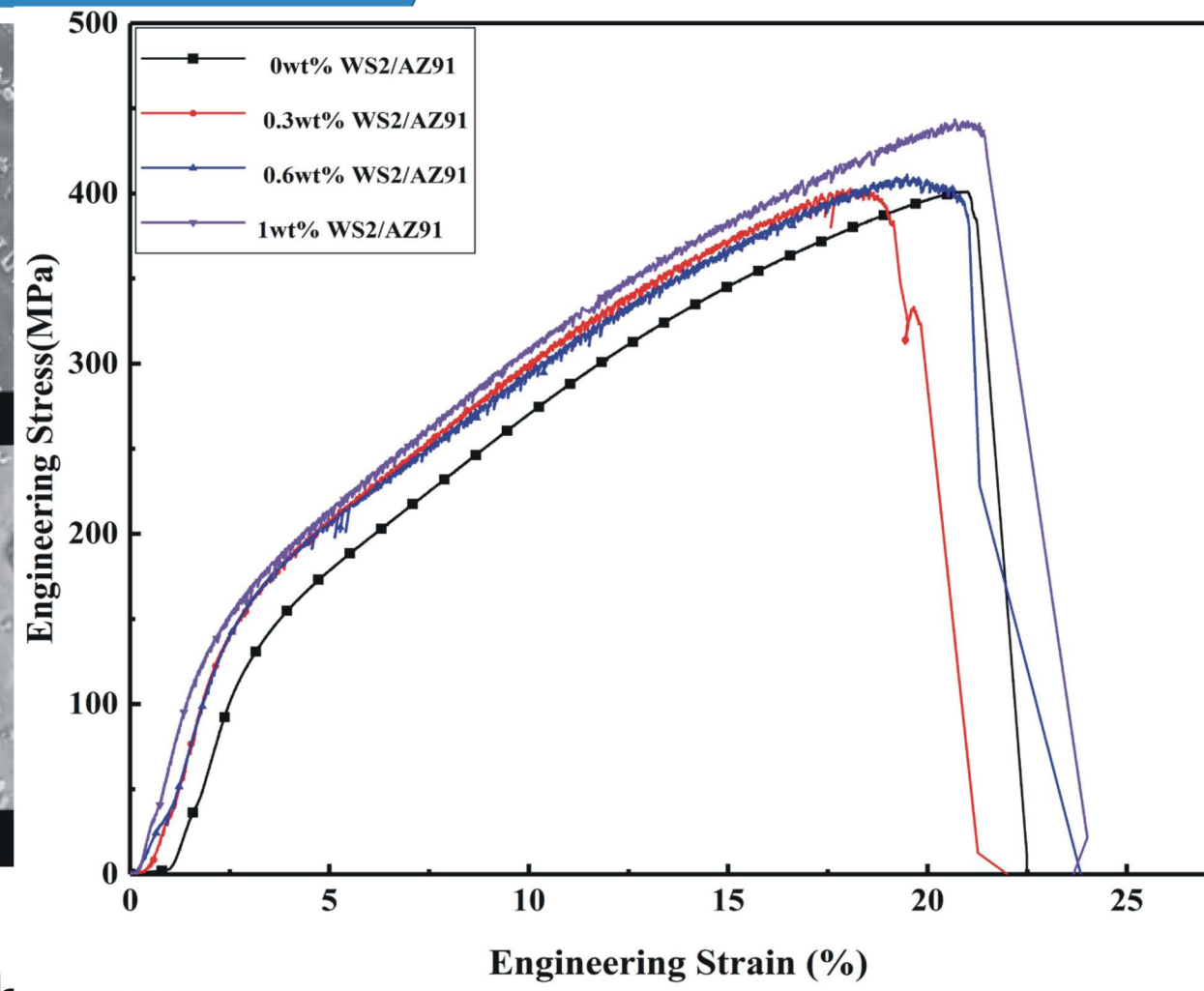


Fig. 3. Stress strain relation for as-cast WS2/AZ91

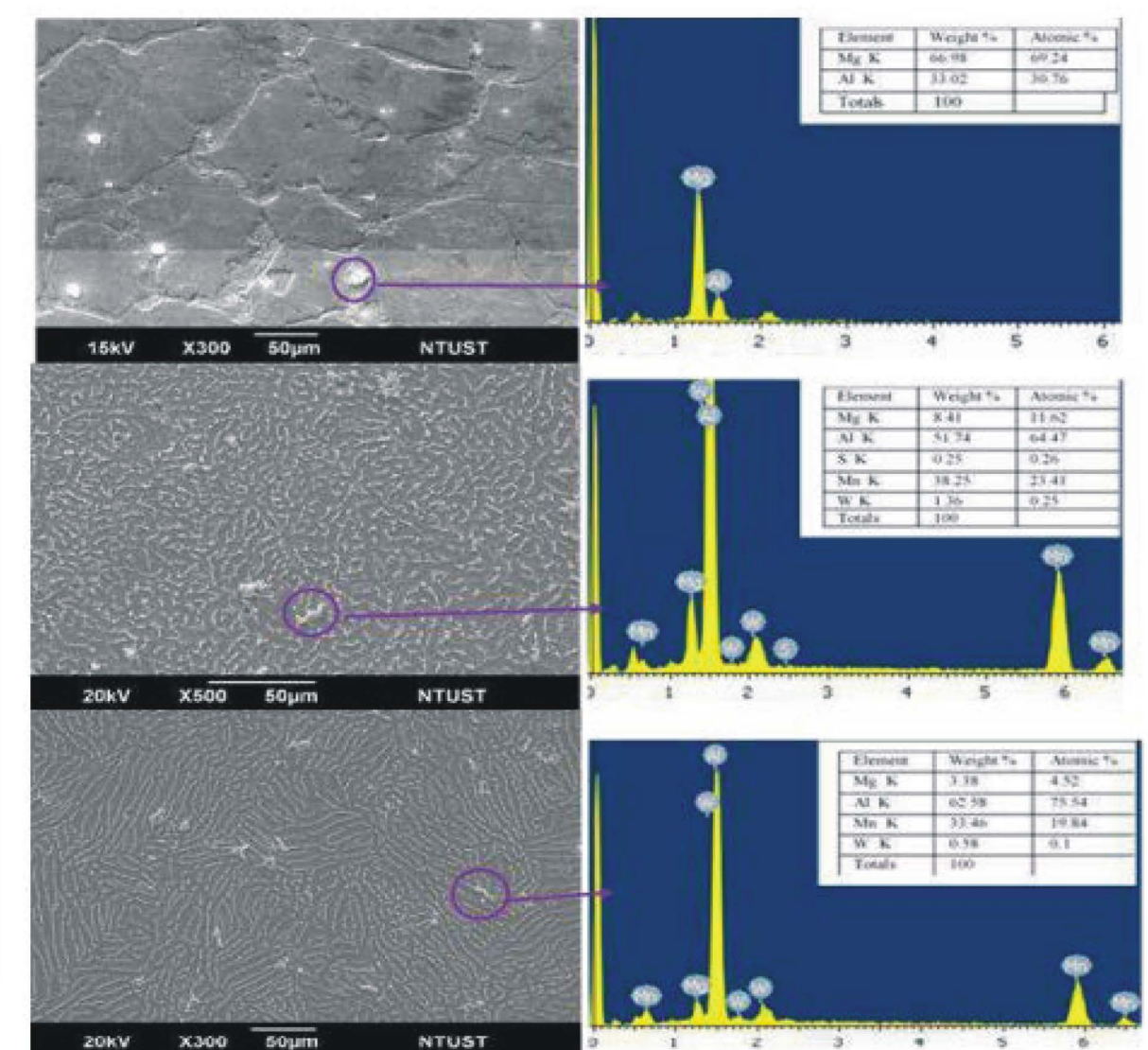


Fig. 4. SEM images of (a) OP (b) 3P and (c) 4P WS2/AZ91

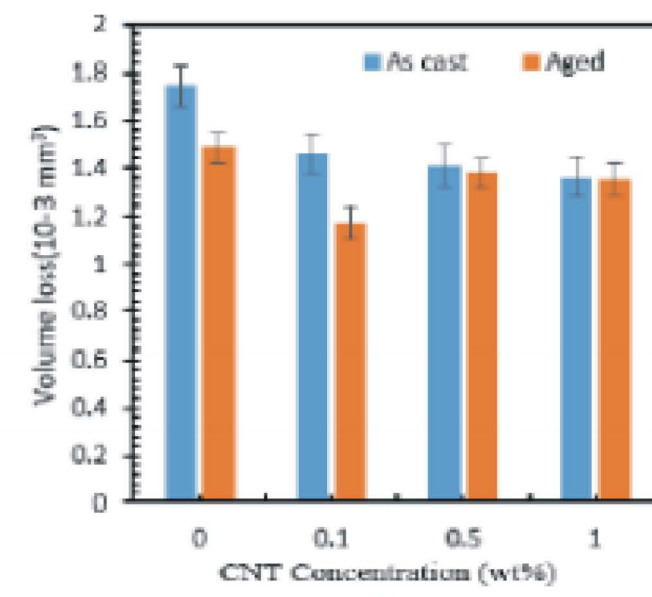
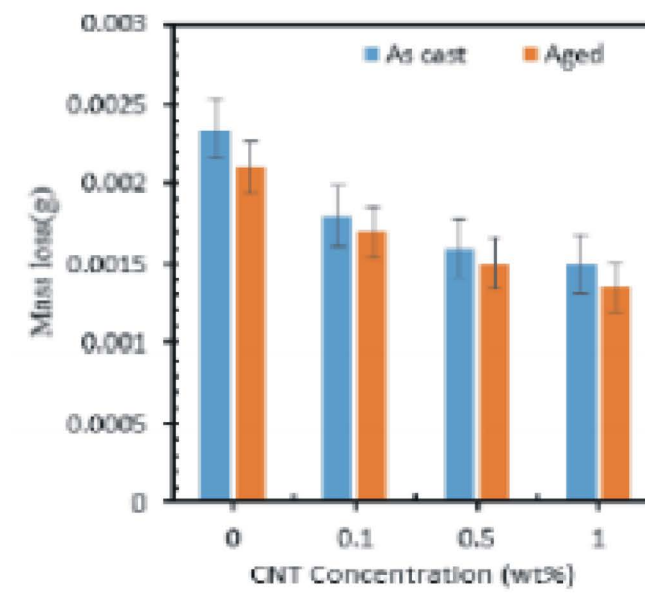
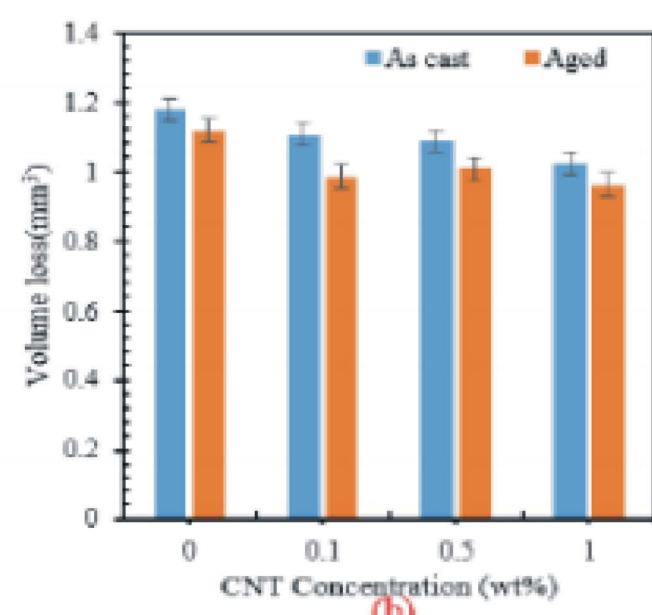
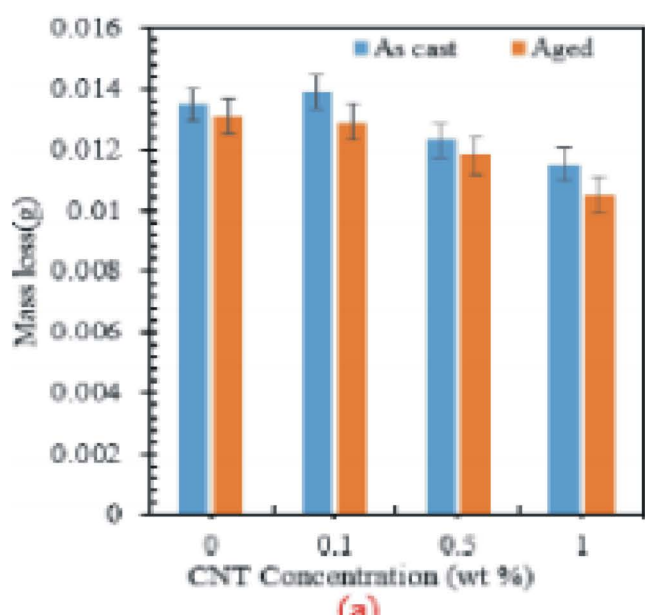


Fig. 5. Effect of CNTs' weight concentration on mass and

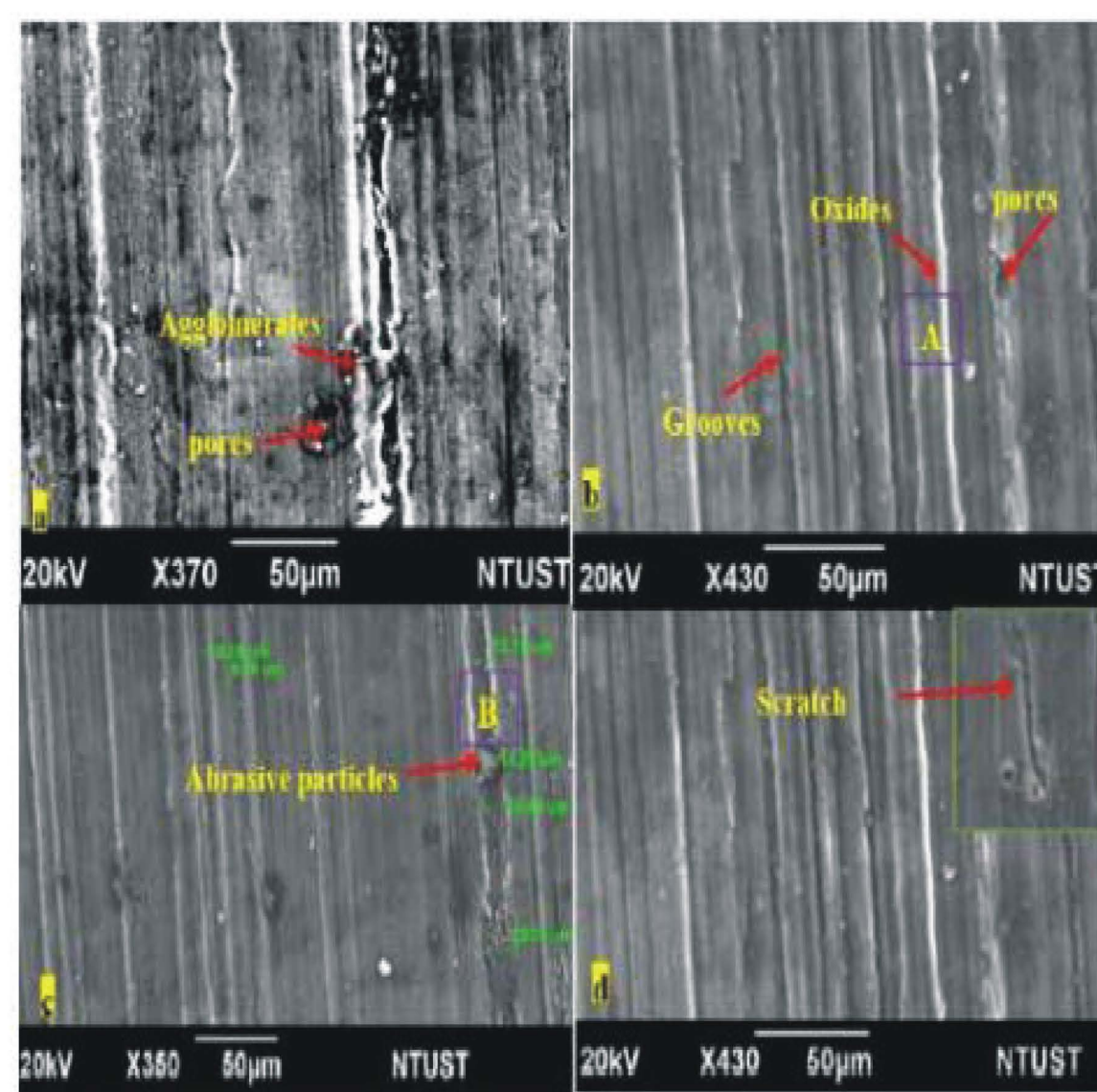


Fig. 6. SEM images of worn surfaces under dry sliding

Summary of This Research

Magnesium is one of the lightest metals. The improvement in strength and wear behavior of magnesium and its alloys had replaced the conventional structural metals. We have tried to improve the strength and tribological behavior of WS2/AZ91 and CNTs/AZ31 metal matrix composites for applications in the electronics industry for mobile phone and laptop covers. It can also be used for piston/cylinder. It can provide a high strength/weight ratio, economical and work under variable temperature conditions.

Selected Journal Publications on this Research

- Aqeel Abbas and Song-Jeng Huang "Effects of tungsten disulfide on microstructure and mechanical properties of AZ91 magnesium alloy manufactured by stir casting," *Alloys and Compound.*, vol. 817, 15 March 2020.
- Aqeel Abbas and Song-Jeng Huang, Beáta Ballóková, Katarína Sülleiová "Tribological effects of carbon nanotubes on magnesium alloy AZ31 and analyzing aging effects on CNTs/AZ31 composites fabricated by stir casting process," *Tribology International.*, Vol 142, Feb 2020
- Aqeel Abbas and Song-Jeng Huang "ECAP effects on microstructure and mechanical behavior of annealed WS2/AZ91 metal matrix composite," *Alloys and Compound.*, vol. 835, 15 Sept 2020.



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