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Effects of different material coatings on the wearing of plowshares in soil tillage

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Abstract: The wearing behavior of coated layers on plowshares used in soil tillage was investigated. Plowshares produced from DIN EN 10 083 (30 MnB5) steel, widely used in plows, were coated with 20 μm hard chromium by electrolysis method, 20 μm electro-less nickel by chemical treatments, and 4 μm titaniumnitride (TiN) by physical vapor deposition to increase wearing resistance. The coated plowshare specimens, together with uncoated plowshare specimens, were mounted on test equipment to analyze their wearing characteristics in a sandy clay loam soil at a speed of 5.8 km h⁻¹. The thickness of the coating and the mass loss of the plowshares were measured each 1.18 km up to 10.8 km for all the coated layers. Before and after tillage, the specimens were analyzed metallographically using a scanning electron microscope (SEM) and energy dispersive spectroscopy (EDS). Abrasive wear occurred on all the plowshares. The wear values for the uncoated and coated plows were in a close range for the tillage length of 10 km in the soil bin. Over that distance, all coated layers showed wear together with the basic material of the plowshare body. The wear length of the electroless nickel coated specimen was higher than the others. However, the TiN coating had a higher wearing resistance than the hard chromium and electroless nickel coatings.

Key words: Metal coating, plowshare, plow, tillage, wear

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