Anticorrosion behaviour and tribological properties of AZ31 magnesium alloy coated with Nb_2O_5/Nb_2O_5-Mg/Mg layers by magnetron sputtering

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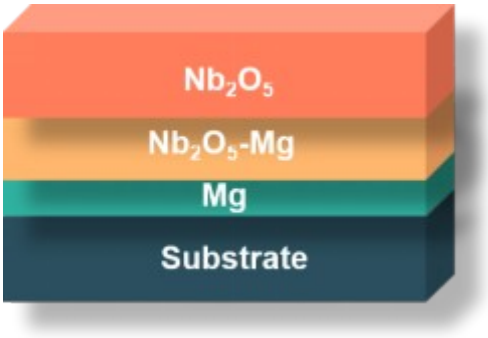


Figure S1. Structural model of M-Nb_2O_5 multilayer coating.

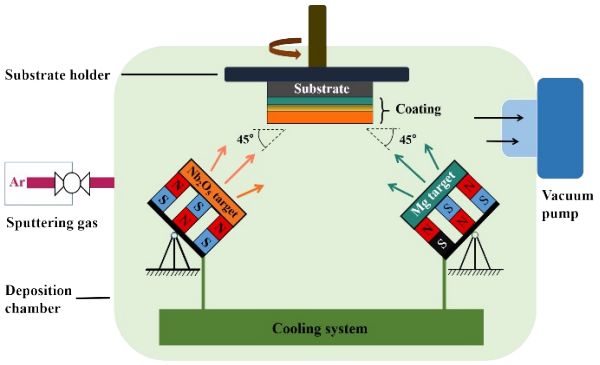


Figure S2. Schematic illustration of the magnetron sputtering system.

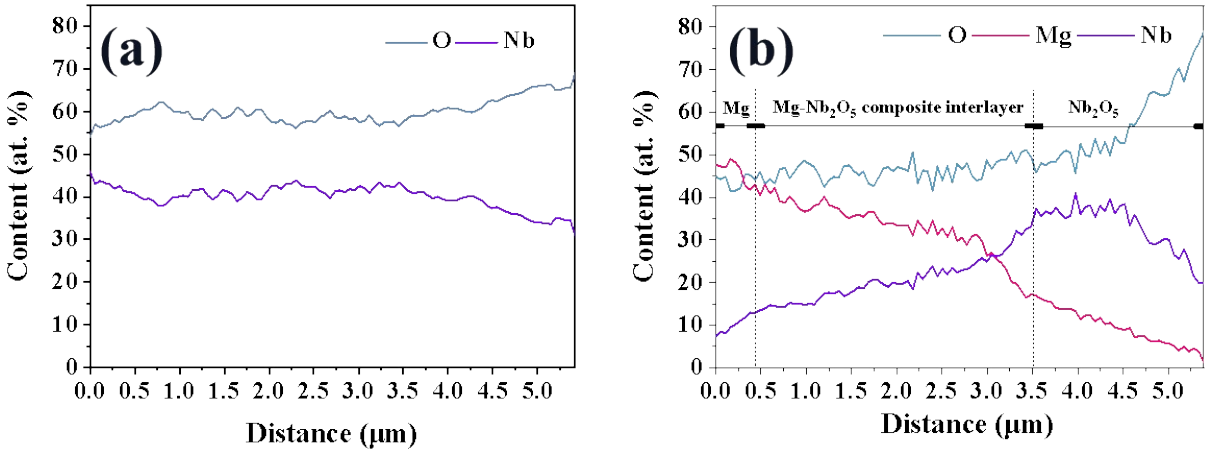


Figure S3. Cross-sectional EDS line scanning of the films: (a) Nb_2O_5, (b) M-Nb_2O_5.

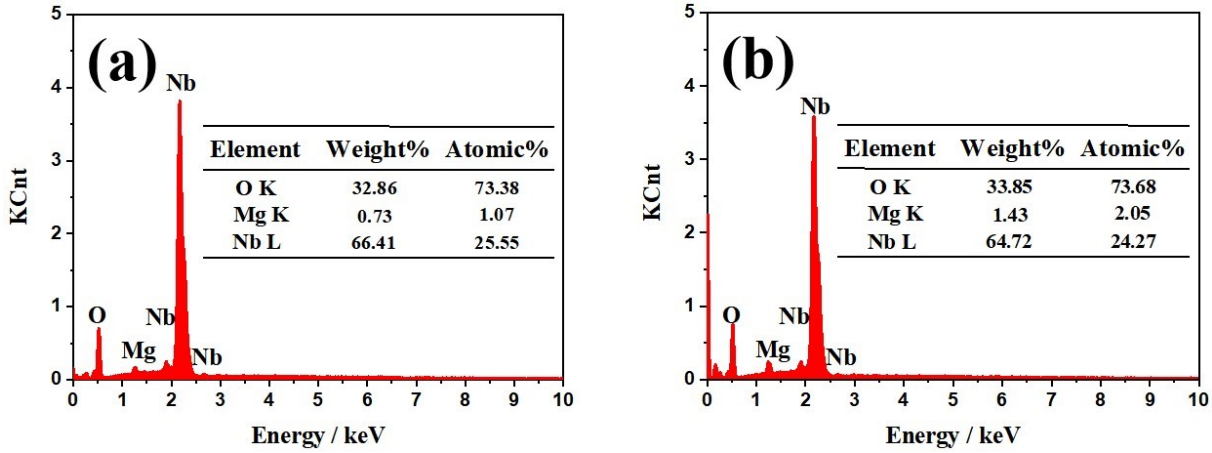
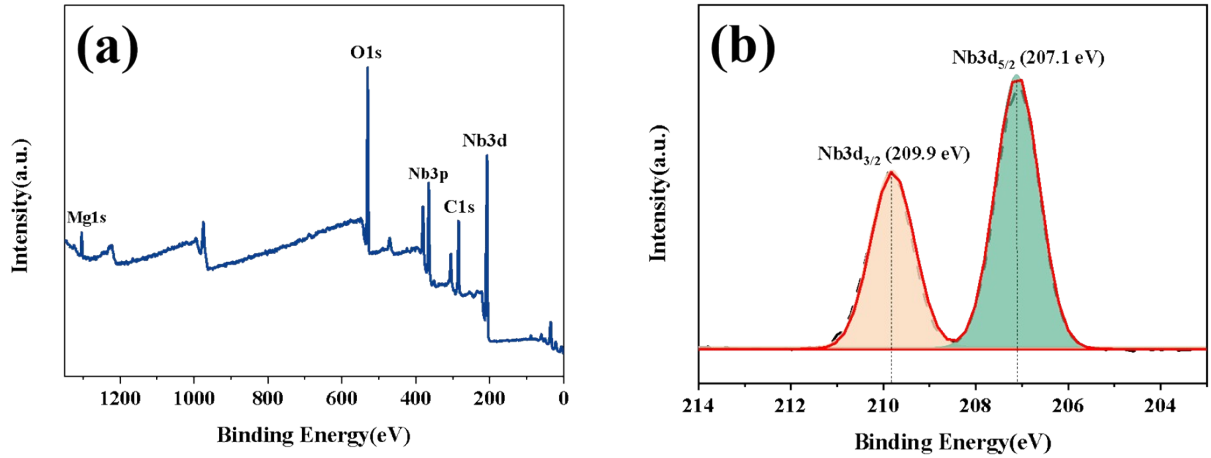


Figure S4. Surface EDS analysis of the layers: (a) Nb_2O_5 , (b) M-Nb_2O_5.



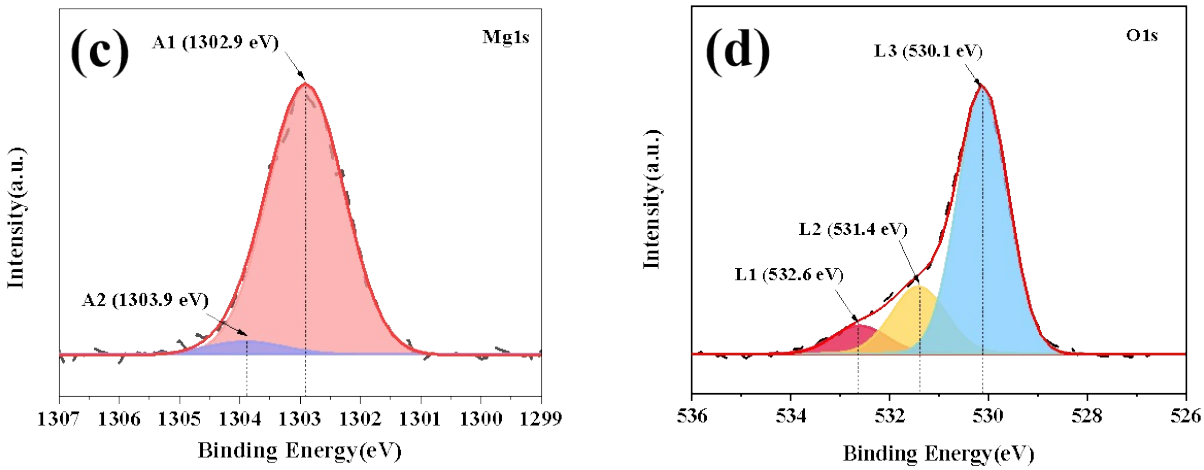


Figure S5. (a) XPS survey spectrum of M-Nb_2O_5 coating and fine spectra of (b) Nb 3d, (c) Mg 1s and (d) O 1s.

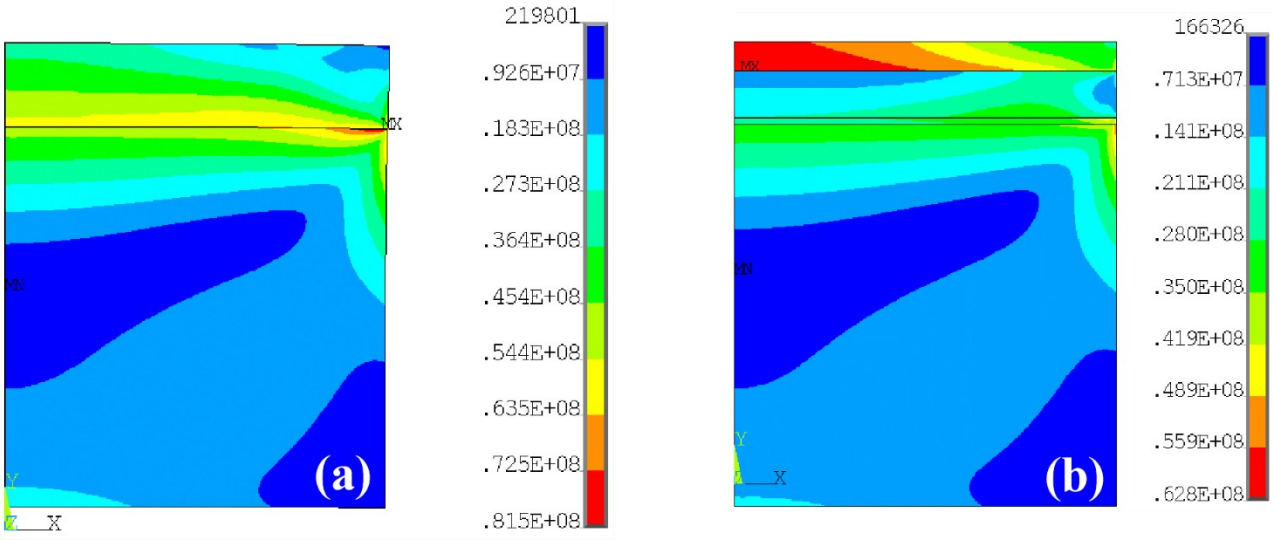


Figure S6. FEM results of residual stress distribution in the coatings: (a) Nb_2O_5 and (b)M-Nb_2O_5.

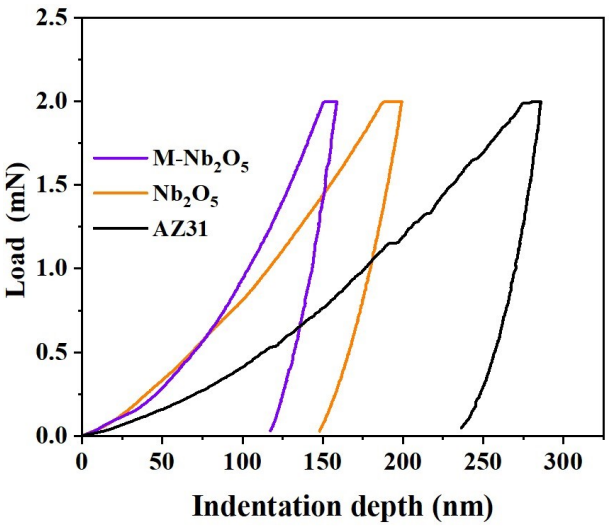


Figure S7. Load-indentation depth curves of naked, Nb_2O_5 and M-Nb_2O_5 coated AZ31 specimens.

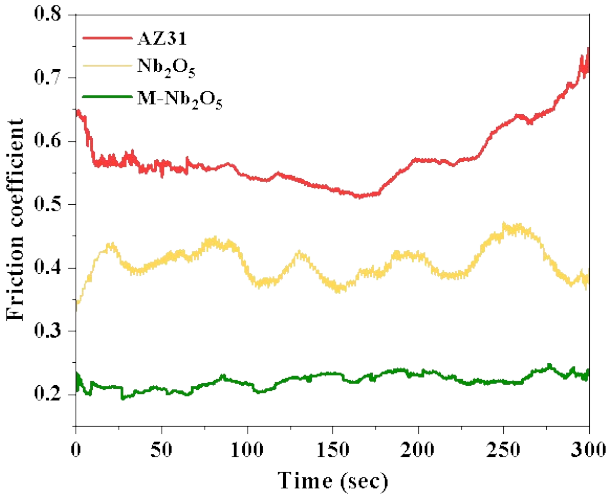


Figure S8. COF curves of untreated, Nb_2O_5, and M-Nb_2O_5 coated AZ31 samples.

Table S1. Deposition parameters of M-Nb_2O_5 multilayer coating.

Deposition parameters		Bottom layer (Mg)	Composite interlayer (Nb_2O_5-Mg)	Top layer (Nb_2O_5)
Sputtering Power (W)	Mg target	60	15	/
	Nb_2O_5 target	/	200	250
Deposition time (min)		10	320	210
Ar Gas flow (sccm)		40		
Background pressure (Pa)		1×10^{-3}		

Table S2. Performance parameters of layer and matrix materials.

Materials properties	Young's modulus (GPa)	Poisson's ratio	Coefficient of thermal expansion (10^{-6} /K)
AZ31[1]	45	0.35	26.8
Mg[2]	44.8	0.35	25.2
Nb_2O_5-Mg[3]	52.4	0.275	15.5
Nb_2O_5[4]	60	0.2	5.8

Reference

1 H. Hu, D. Zhang, F. Pan and M. Yang, *J Wuhan Univ Technol*, 2009, **24**, 376-382.

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Table 3S. Corrosion parameters of naked and coated AZ31 specimens in SBF solution.

Sample	E_{corr} (V vs.Ag/AgCl)	i_{corr} (A cm^{-2})
AZ31	-1.63	6.46×10^{-5}
Nb_2O_5	-1.54	3.43×10^{-5}
M-Nb_2O_5	-1.44	4.04×10^{-6}