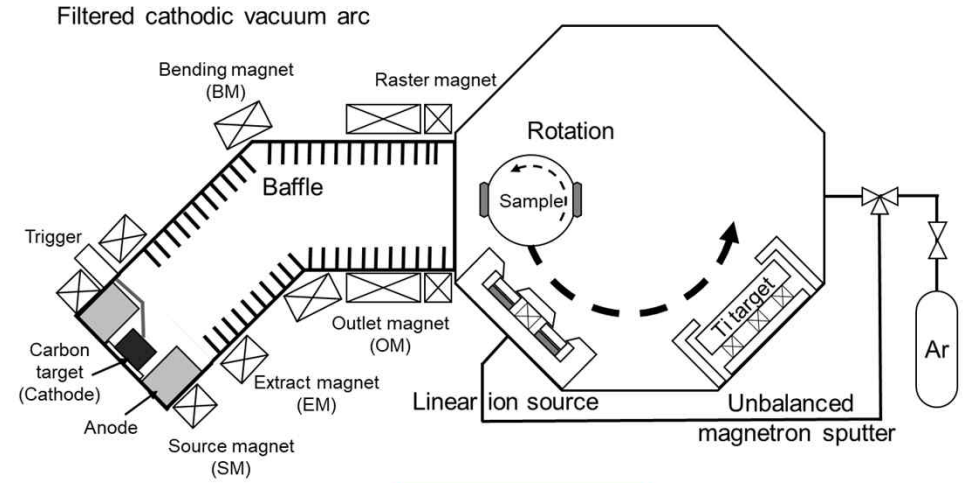
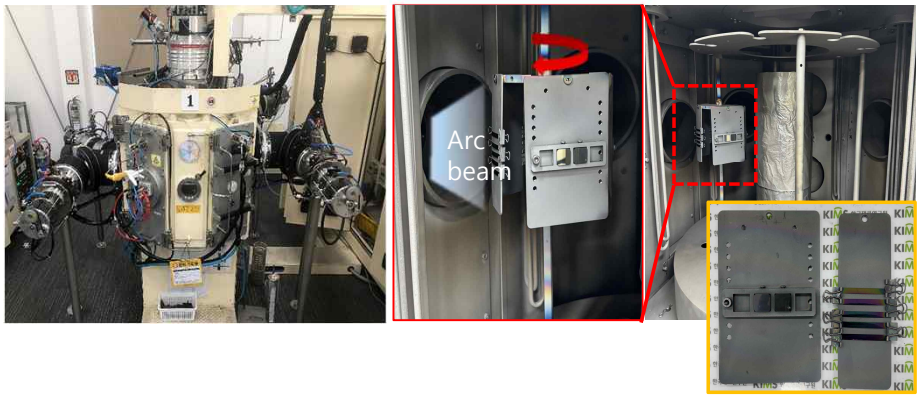
Experimental

Experimental equipment and processes

Experimental equipment





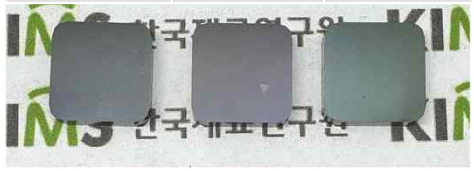
Processes

Substrate : SUS304 Strip, WC-Co

***U/P : 3 E^{-5} torr**

Case	Process	Condition	Bias	Time	
Case1,2	Ion cleaning	2.5 kV, 400 mA, Ar gas 60 sccm	-100 V	19 min(-200 nm)	
Case1,2	Sputtering(Ti)	2.5 kV, 400 mA, Ar gas 60 sccm	-100 V	35 min(+500 nm)	
Case1	FCVA(ta-C:Soft)	Duct 15 V, 80 A	-200 V, -300 V, -500 V	18 min (+250nm)	X 5 = **2.5 μm**
	FCVA(ta-C:Hard)		-70 V	18 min (+250 nm)	
Case2.	FCVA(ta-C:Soft)	Duct 15 V, 80 A	-300V or 500 V	7 min (+100 nm)	X 12, 8, 6 and 5 = **2.4 and 2.5 μm**
	FCVA(ta-C:Hard)		-70 V	7, 14, 21, 28, (+100, 200, 300, 400 nm)	

Case. 1 Sample			Case. 2 -500V/-70V Sample				Case. 2 -300V/-70V	
-200V/-70V	-300V/-70V	-500V/-70V	1:1	1:2	1:3	1:4	1:2	1:3



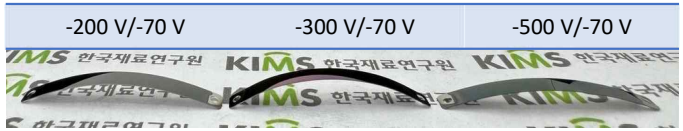
Experiment results

Stress and mechanical properties

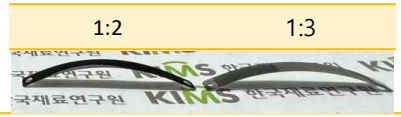
Stress strip change after coating

Single layer stress strip

Multi layer Case. 1 stress strip

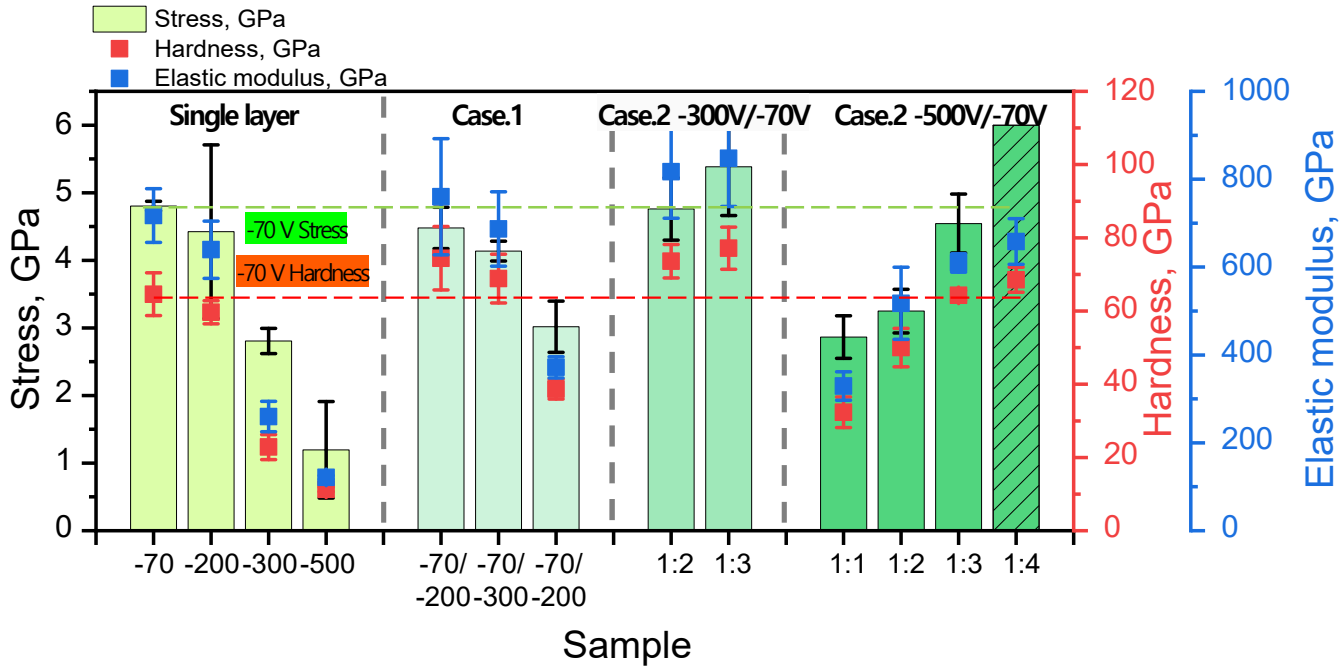


Case2. -300V/-70V stress strip



Multi layer Case2. -500V/-70V stress strip

Stress, hardness and elastic modulus



Lower stress and higher hardness achieved as soft-layer bias decreases and hard-layer ratio increases compared to the single –70 V ta-C layer.