Group Meeting

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Adviser: Prof. J. C. Huang

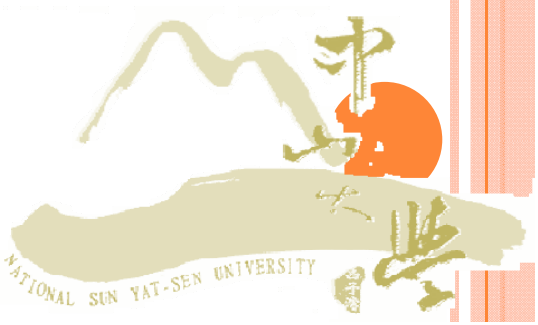
05/04/2011

National Sun Yat-Sen University (NSYSU)

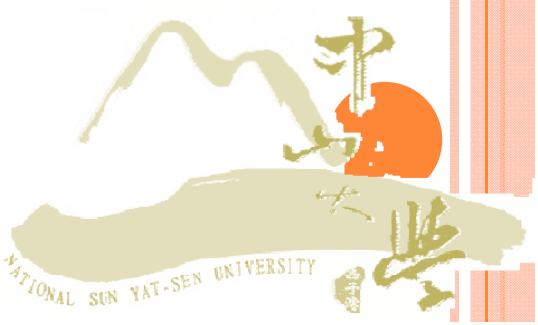
Department of Materials and Optoelectronic Science

Outline

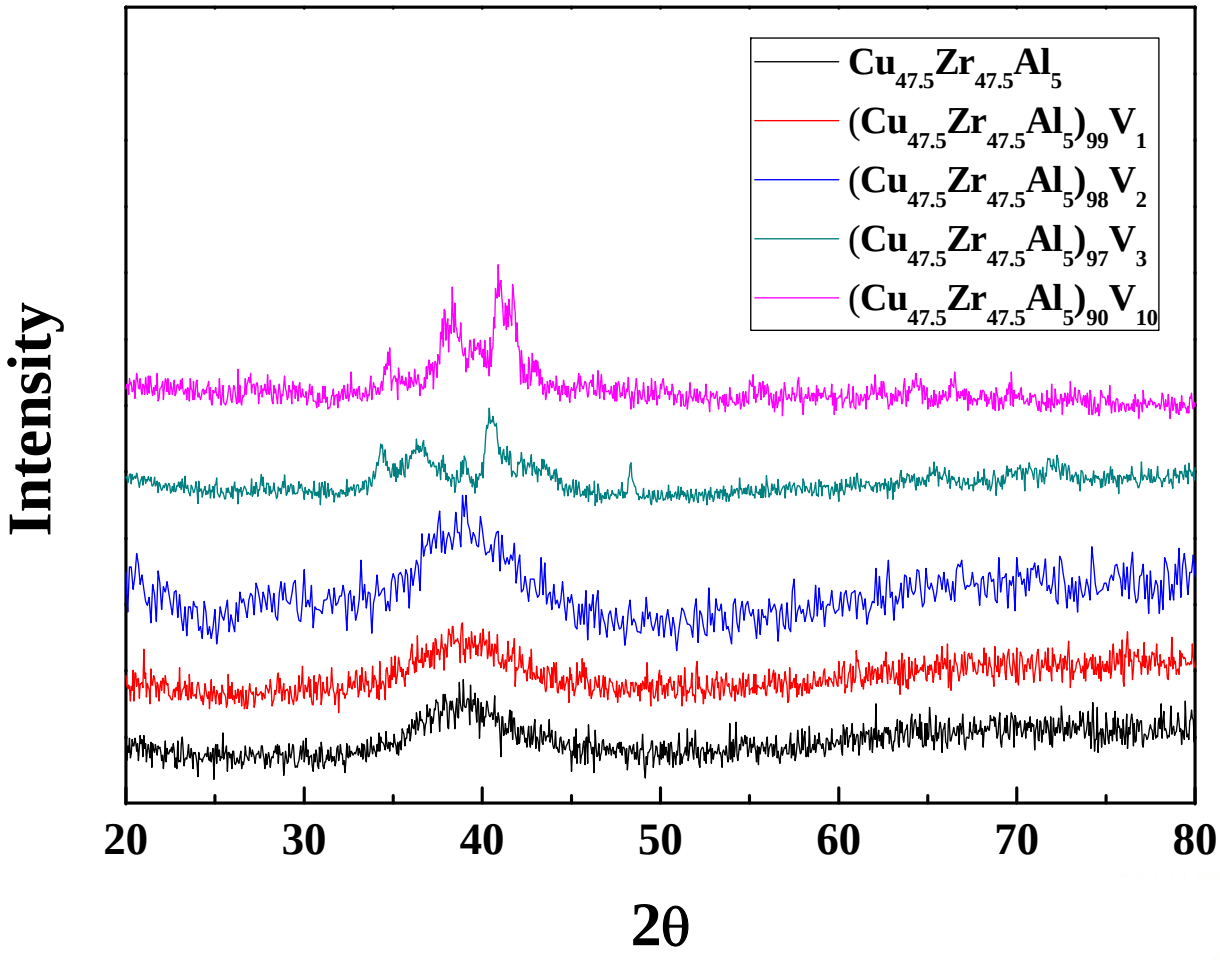
- V addition effects in $(Cu_{47.5}Zr_{47.5}Al_5)_{100-x}V_x$(x = 0, 1, 2, 3, 5, and 10) alloys
- Precipitation size and shape effects in V or Co addition alloys



V addition effects in $(Cu_{47.5}Zr_{47.5}Al_5)_{100-x}V_x$(x = 0, 1, 2, 3, 5, and 10) alloys

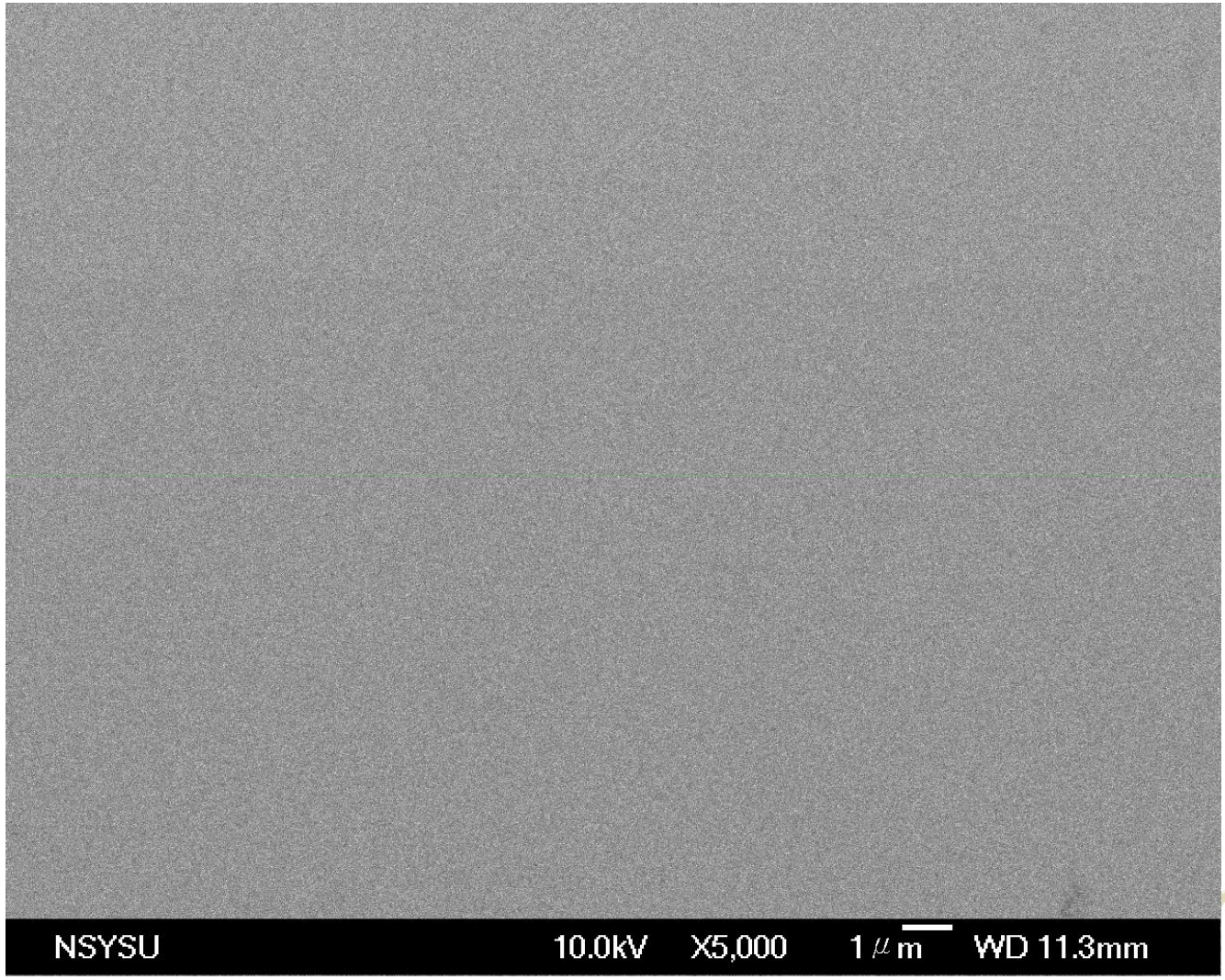


XRD results



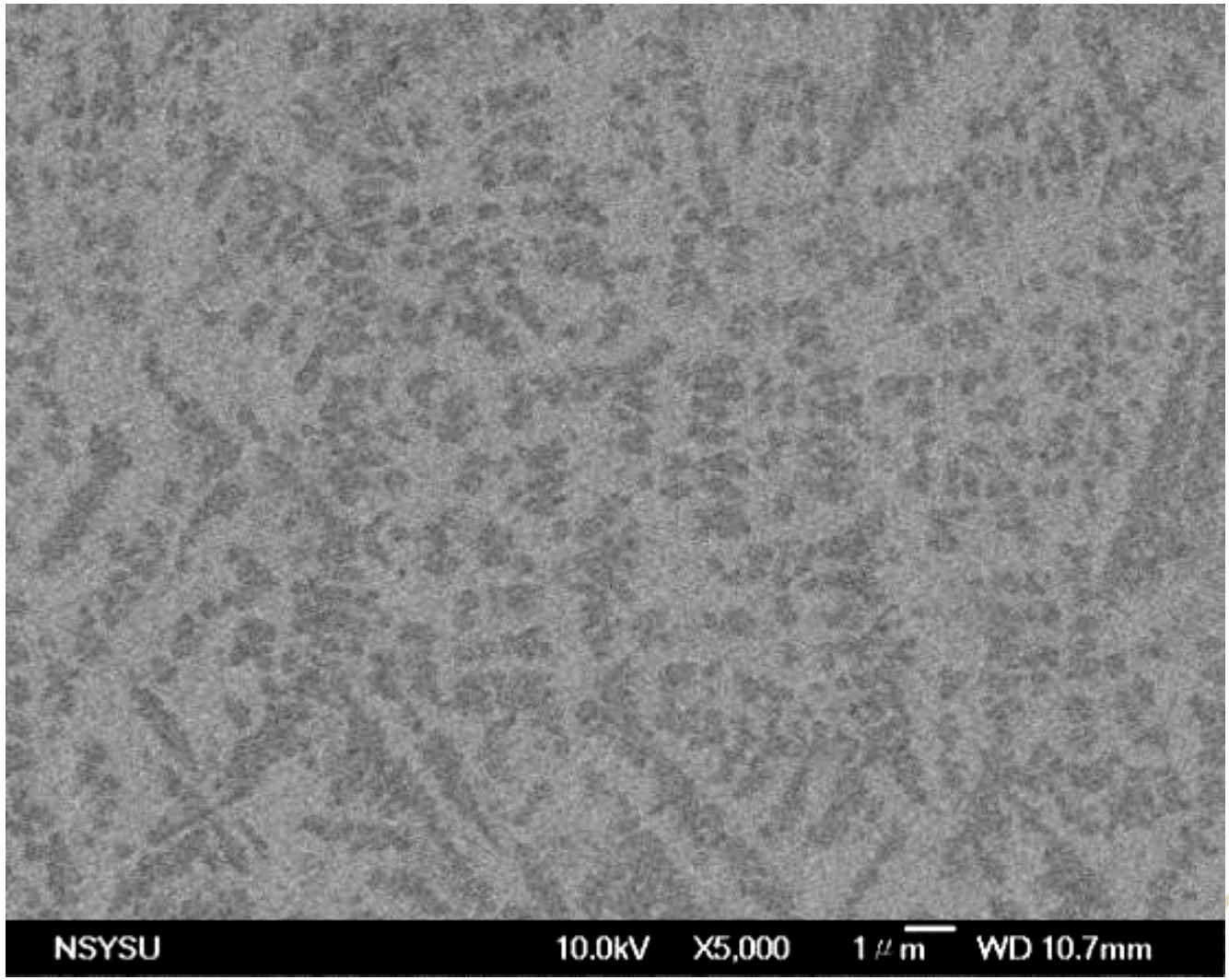
X-ray diffraction patterns of $(Cu_{47.5}Zr_{47.5}Al_5)_{100-x}V_x$ (x = 0, 1, 2, 3, 10)

SEM/BEI image



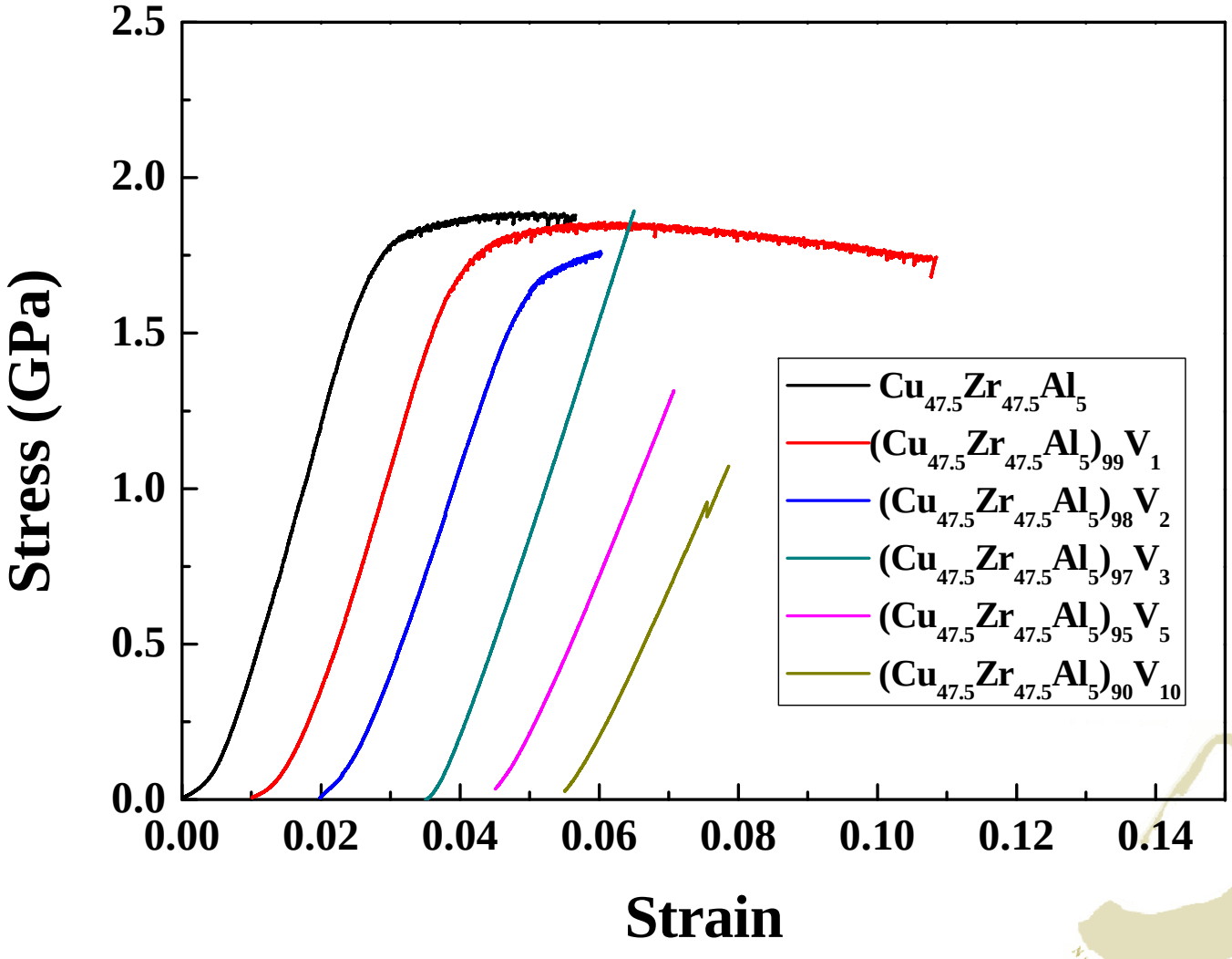
The BEI observation of $(Cu_{47.5}Zr_{47.5}Al_5)_{98}V_2$

SEM/BEI image



The BEI observation of $(Cu_{47.5}Zr_{47.5}Al_5)_{90}V_{10}$

Compression results



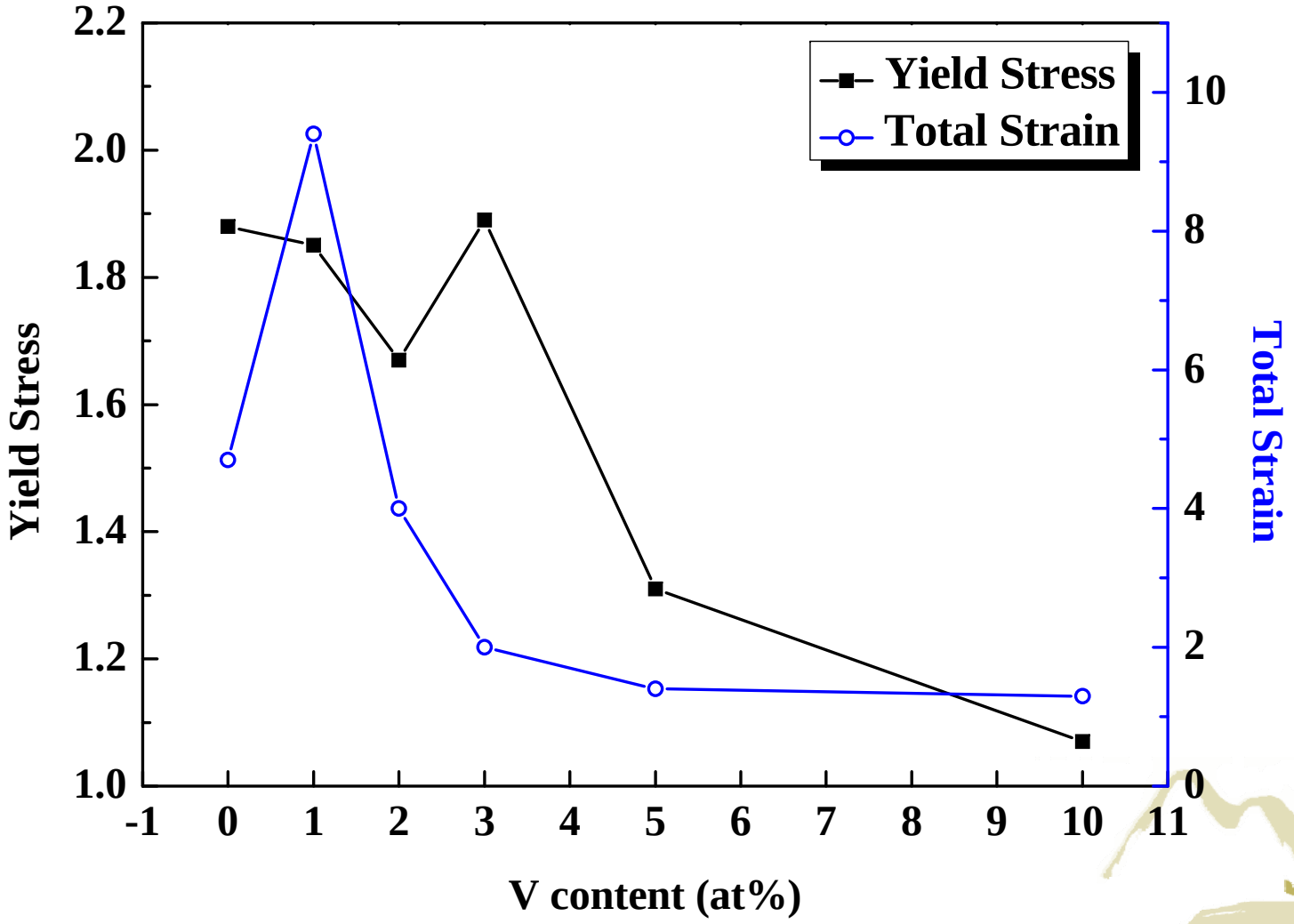
Mechanical properties

Summary of mechanical properties for the as-cast Cu-based BMG with a strain rate of 1 x 10^{-4} s^{-1} at room.

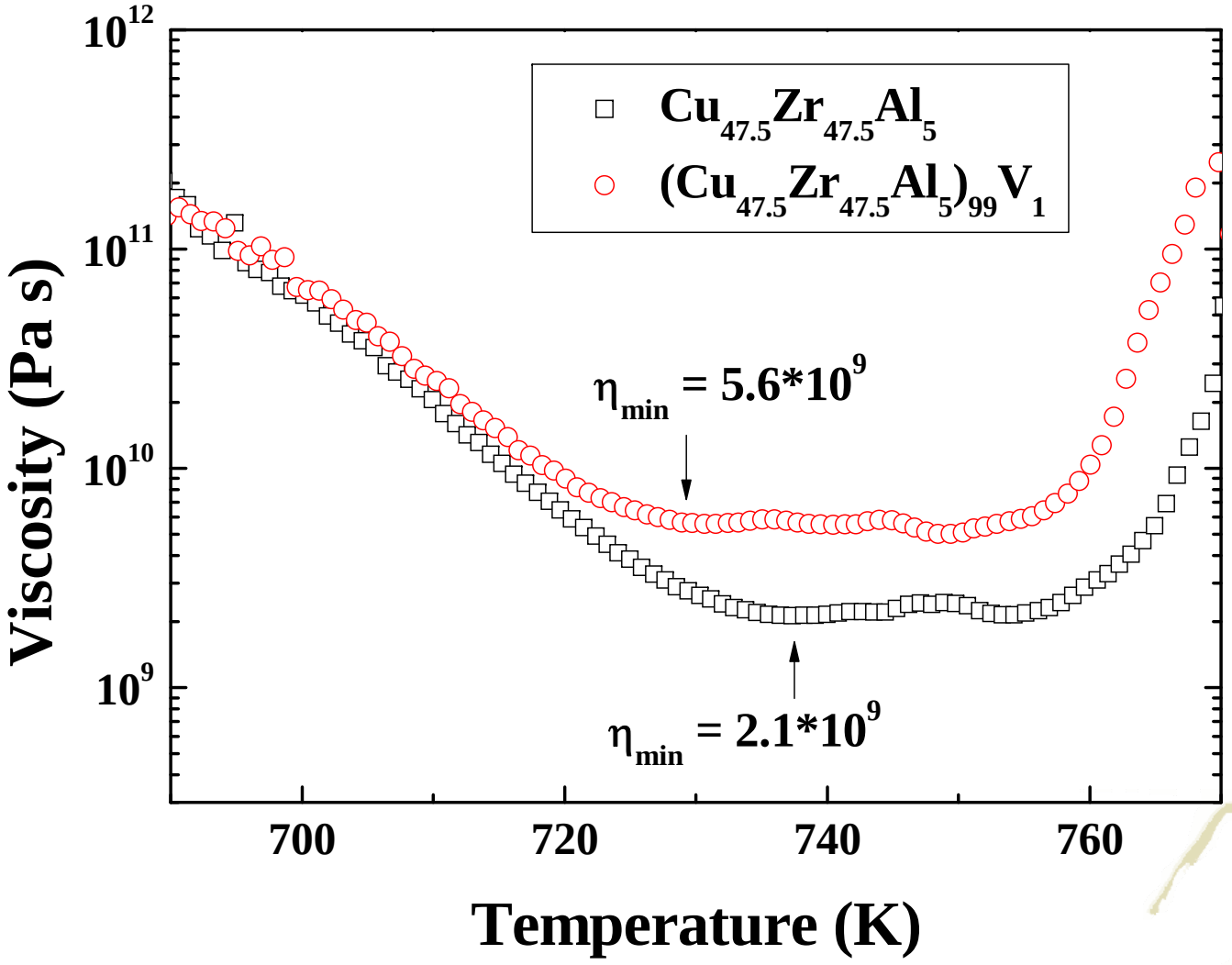
Composition	E (GPa)	σ_y (GPa)	ε_e (%)	ε_p (%)	ε_t (%)
$Cu_{47.5}Zr_{47.5}Al_5$	90	1.88	2.0	2.7	4.7
$(Cu_{47.5}Zr_{47.5}Al_5)_{99}V_1$	90	1.85	2.0	7.4	9.4
$(Cu_{47.5}Zr_{47.5}Al_5)_{98}V_2$	90	1.67	2.0	2.0	4.0
$(Cu_{47.5}Zr_{47.5}Al_5)_{97}V_3$	90	1.89	2.0	0	2.0
$(Cu_{47.5}Zr_{47.5}Al_5)_{95}V_5$	88	1.31	1.4	0	1.4
$(Cu_{47.5}Zr_{47.5}Al_5)_{90}V_{10}$	86	1.07	1.3	0	1.3

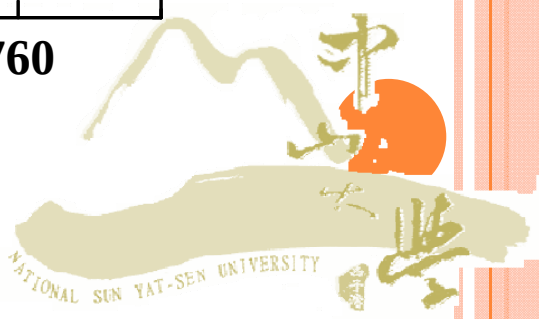
E: elastic modulus
σ_y: yielding strength
ε_e: elastic strain
ε_p: plastic strain
ε_t: total strain

Mechanical properties



Viscosity


10^{12}
10^{11}
10^{10}
10^{9}
Viscosity (Pa s)
$Cu_{47.5}Zr_{47.5}Al_5$
$(Cu_{47.5}Zr_{47.5}Al_5)_{99}V_1$
η_{min} = 5.6*10^9
η_{min} = 2.1*10^9
700
720
740
760
Temperature (K)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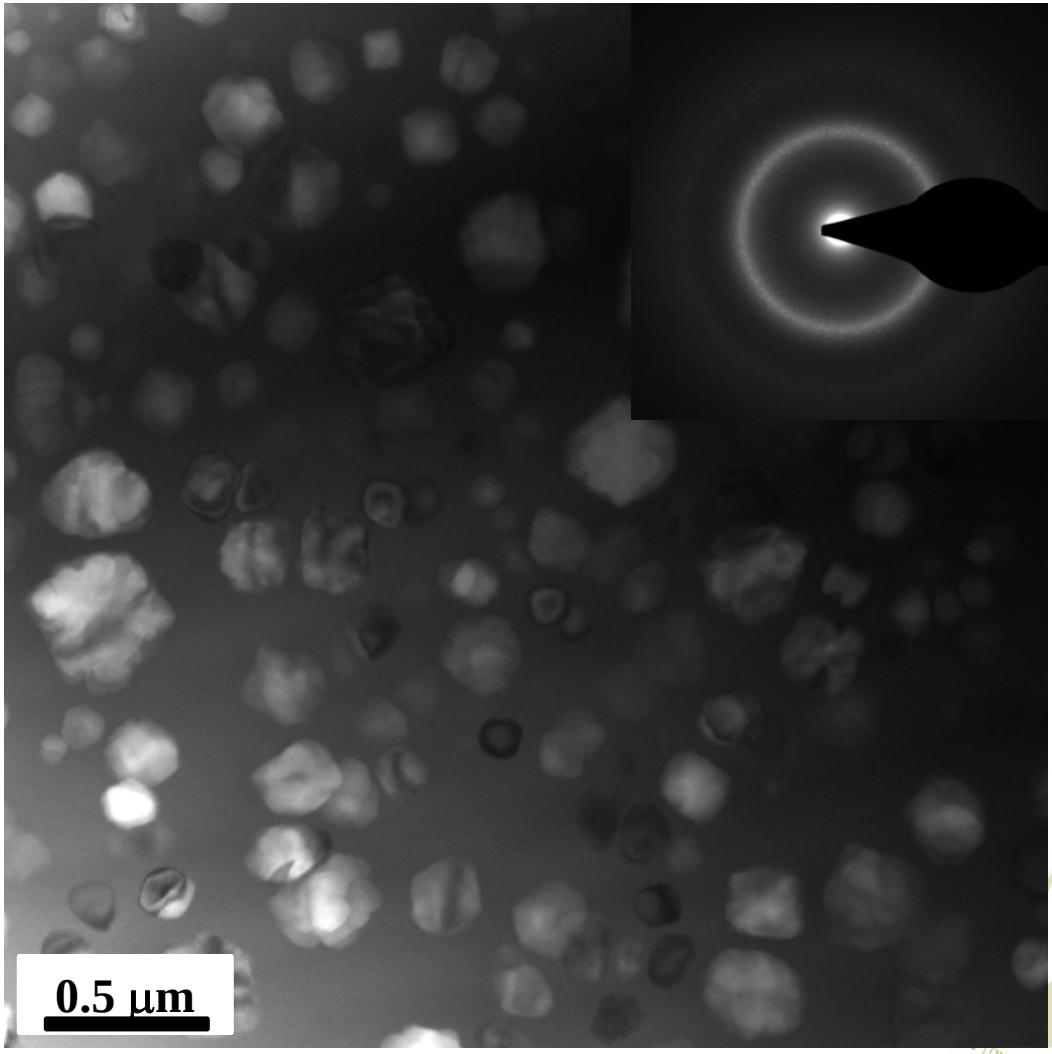
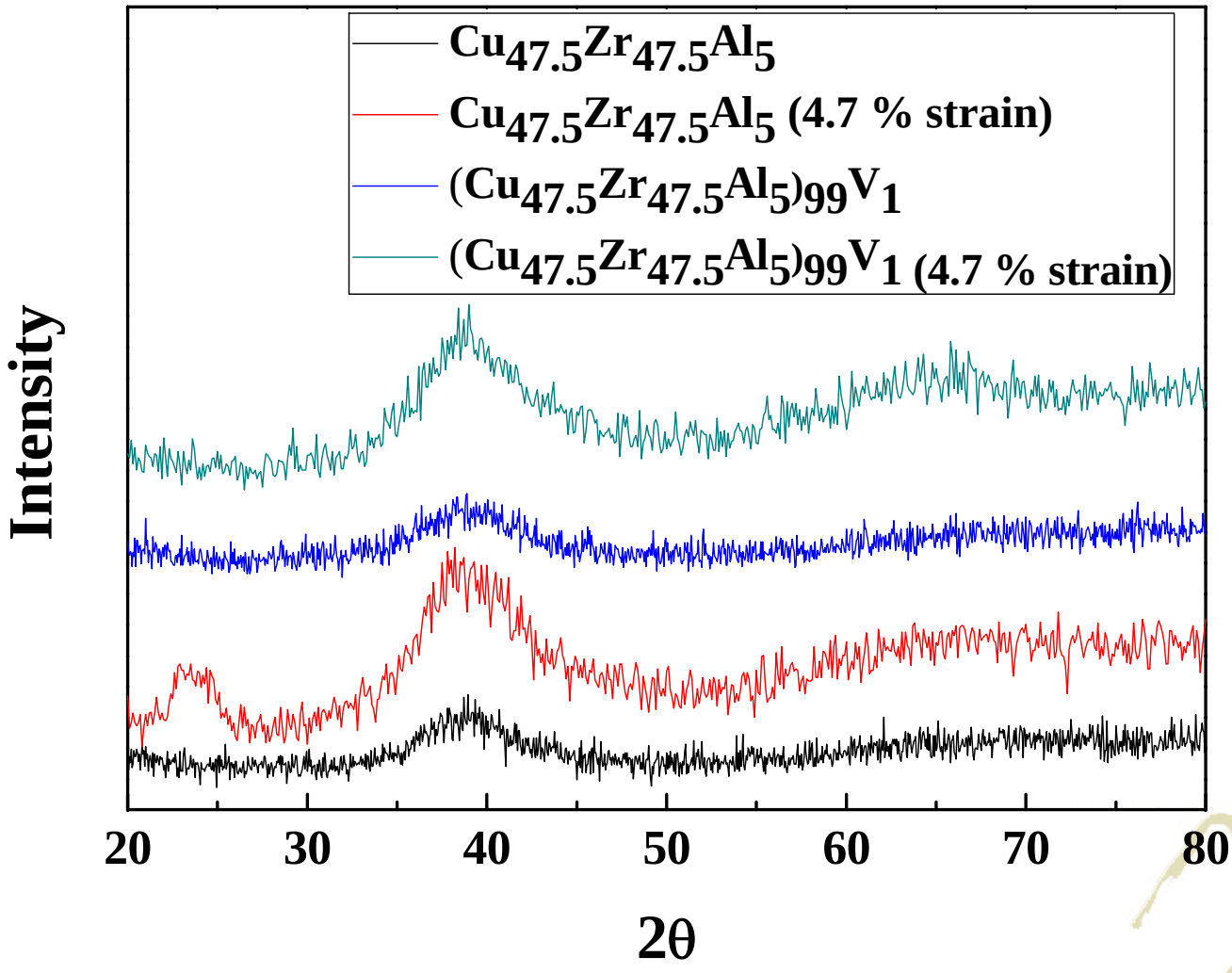
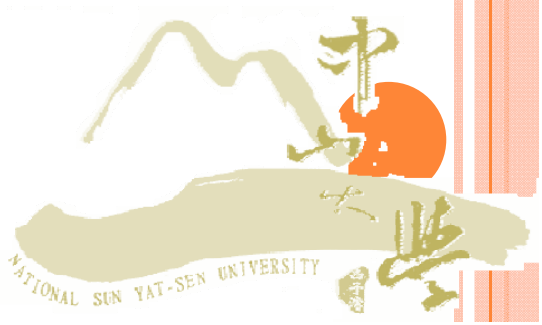
BF Image of $(Cu_{47.5}Zr_{47.5}Al_5)_{99}V_1$



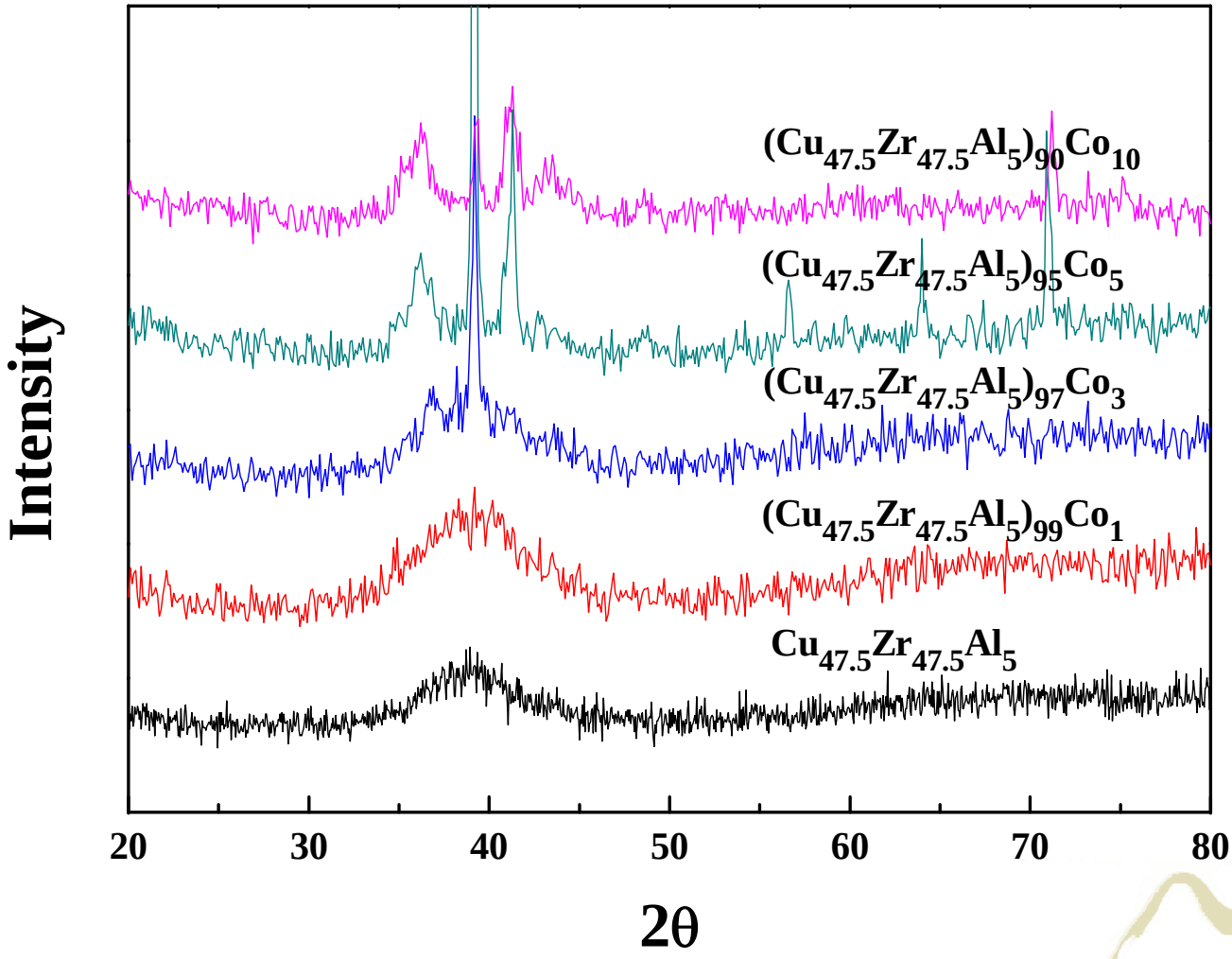
XRD results



Precipitation size and shape effects in V or Co addition alloys

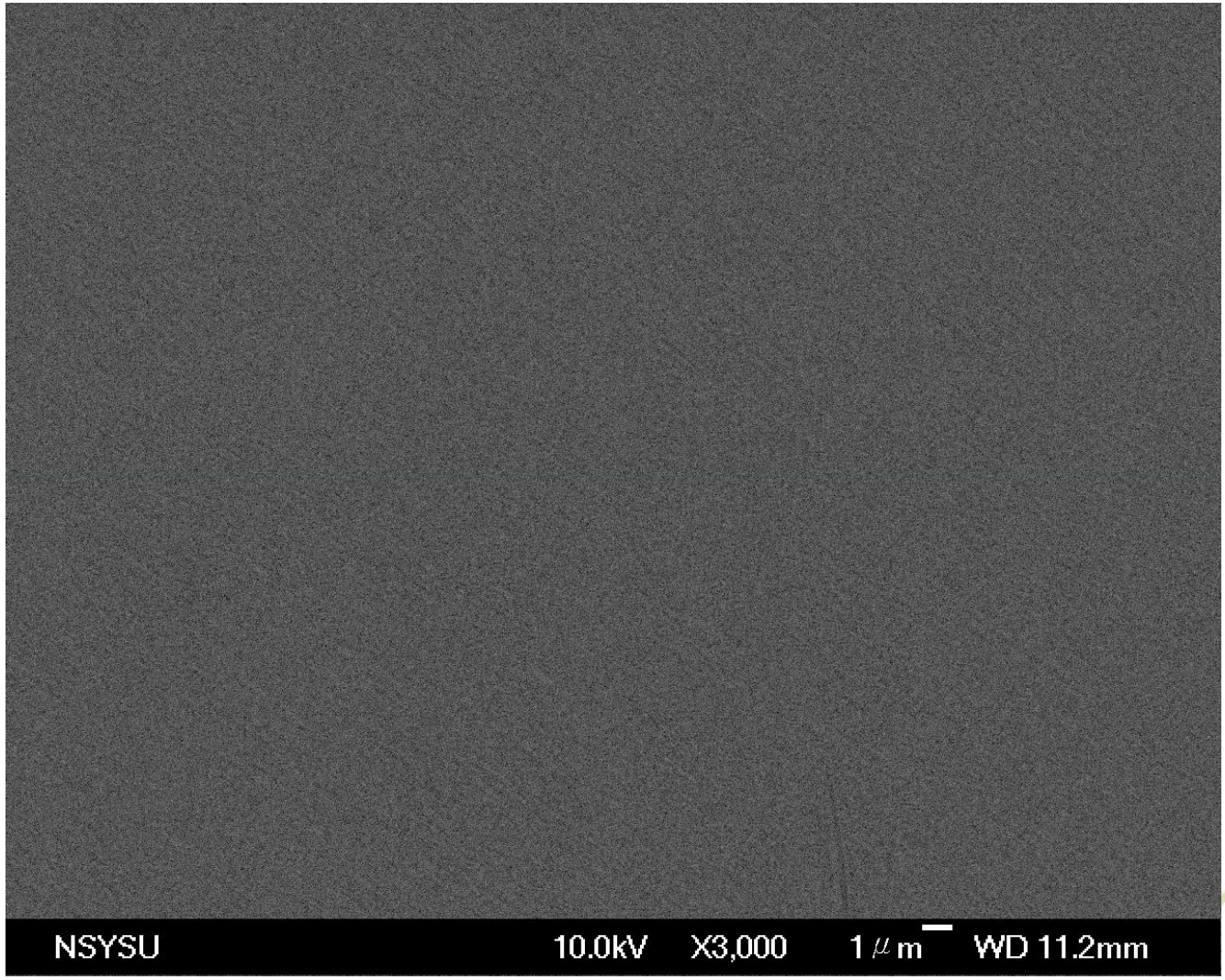


XRD results



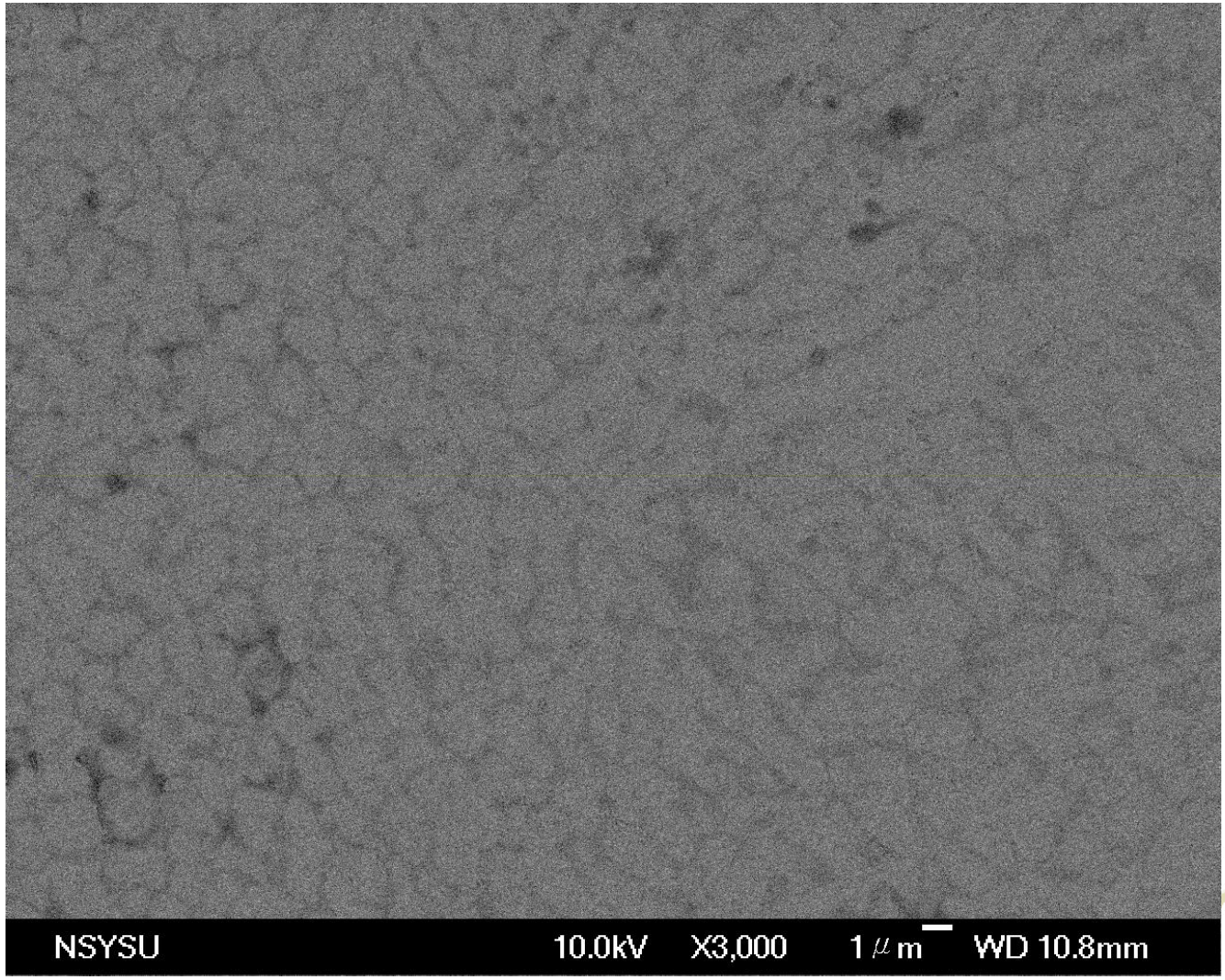
The XRD results show that there are $Co_7Zr_6Al_{16}$ compounds in $(Cu_{47.5}Zr_{47.5}Al_5)_{100-x}Co_x$ (x = 3, 5, and 10) alloys.

SEM/BEI image



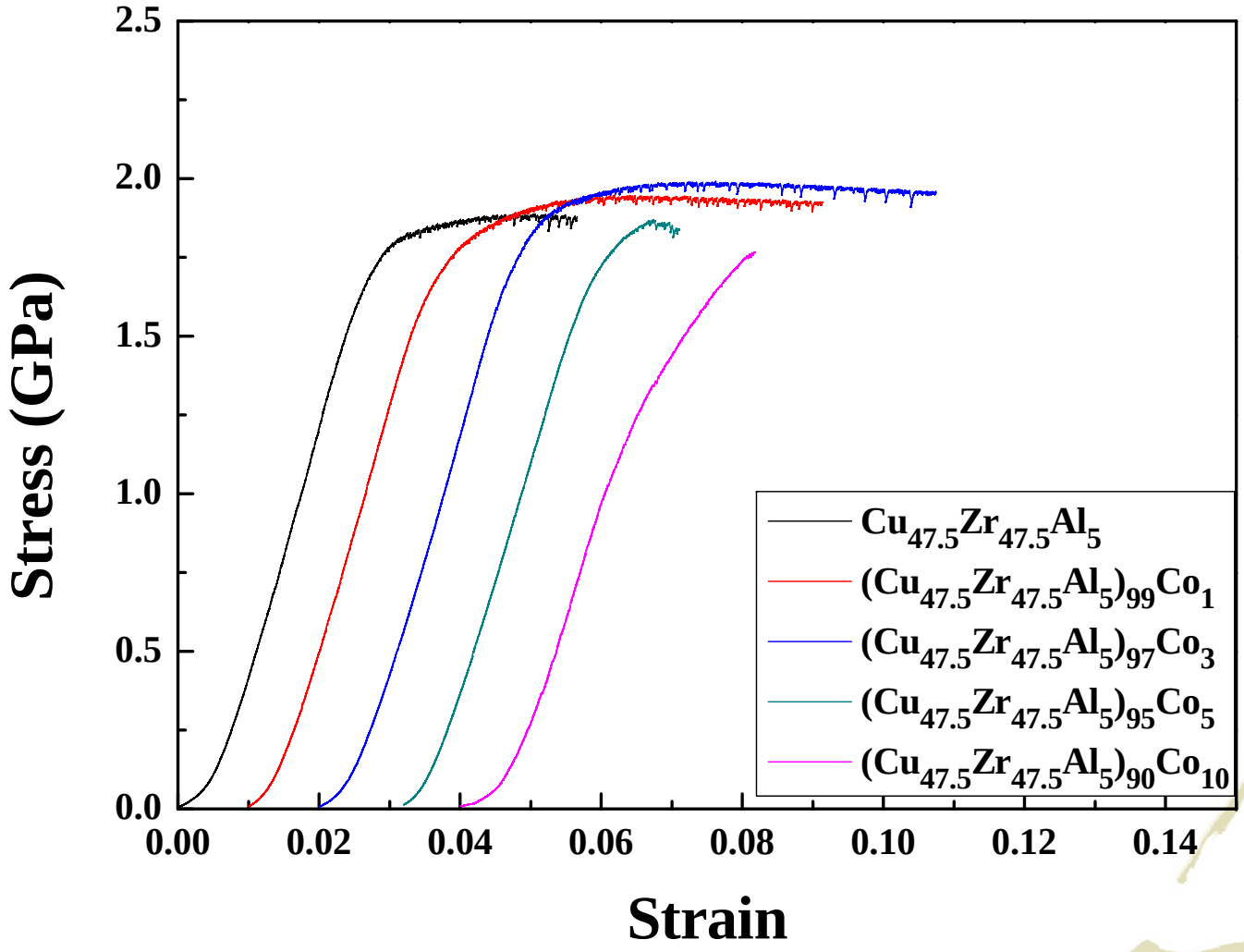
The BEI observation of $(Cu_{47.5}Zr_{47.5}Al_5)_{99}Co_1$

SEM/BEI image



The BEI observation of $(Cu_{47.5}Zr_{47.5}Al_5)_{90}Co_{10}$

Compression results



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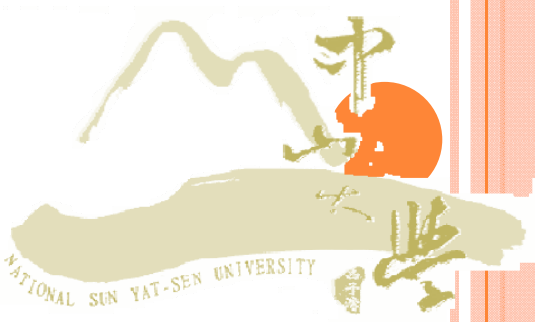
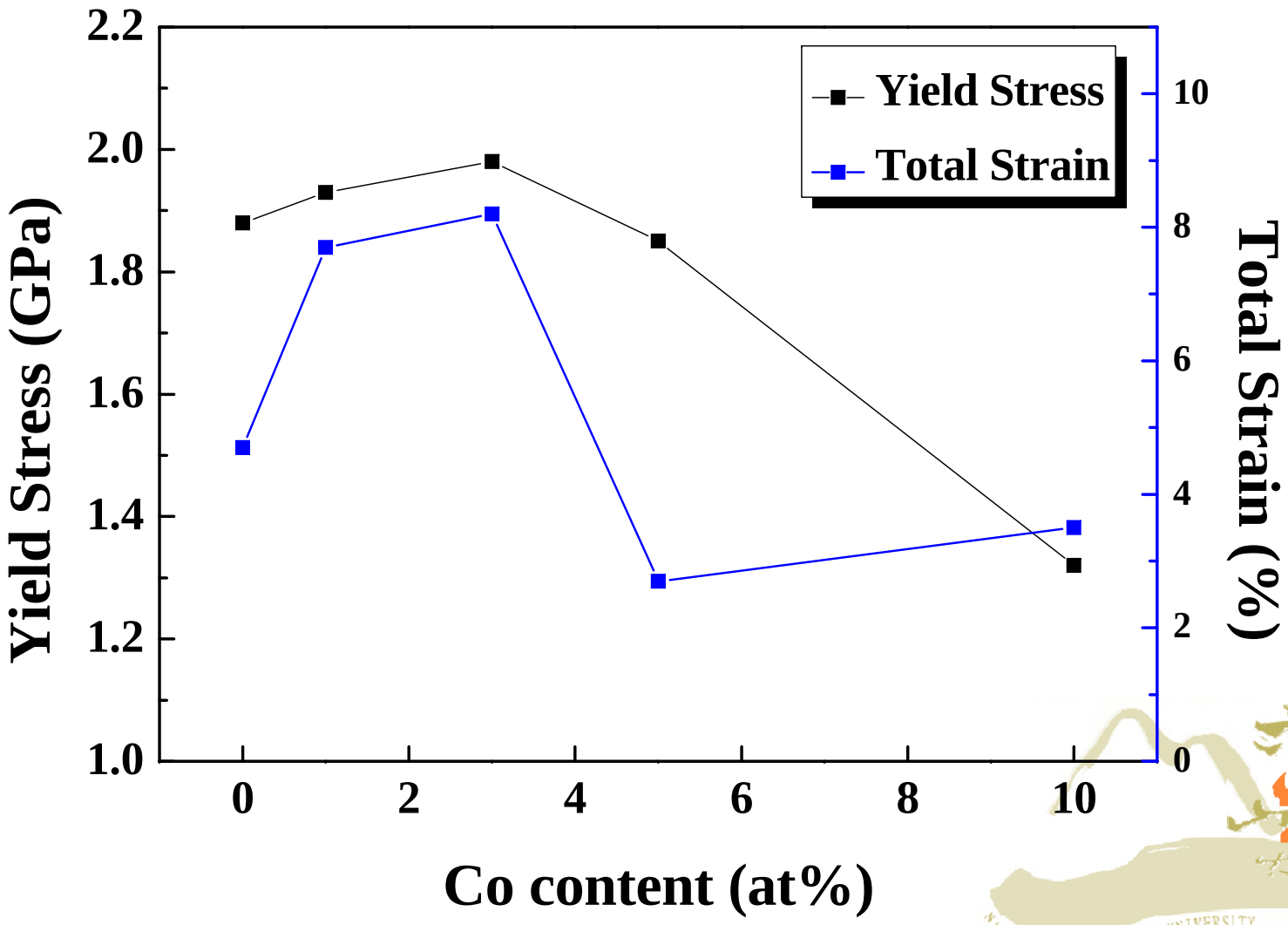
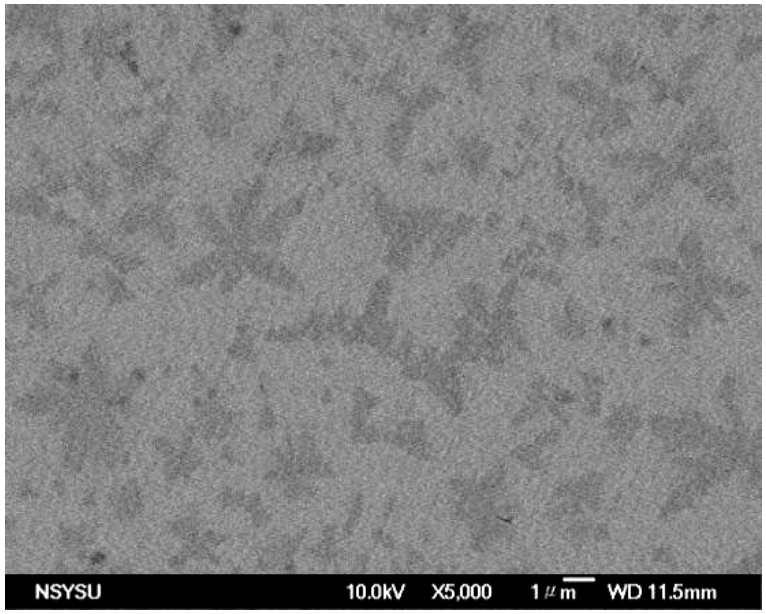
$Cu_{47.5}Zr_{47.5}Al_5$	90	1.88	2.0	2.7	4.7
$(Cu_{47.5}Zr_{47.5}Al_5)_{99}Co_1$	90	1.93	2.0	5.7	7.7
$(Cu_{47.5}Zr_{47.5}Al_5)_{97}Co_3$	91	1.98	2.0	6.2	8.2
$(Cu_{47.5}Zr_{47.5}Al_5)_{95}Co_5$	91	1.85	2.0	0.7	2.7
$(Cu_{47.5}Zr_{47.5}Al_5)_{90}Co_{10}$	91	1.32	1.5	2.0	3.5

E: elastic modulus
σ_y: yielding strength
ε_e: elastic strain
ε_p: plastic strain
ε_t: total strain

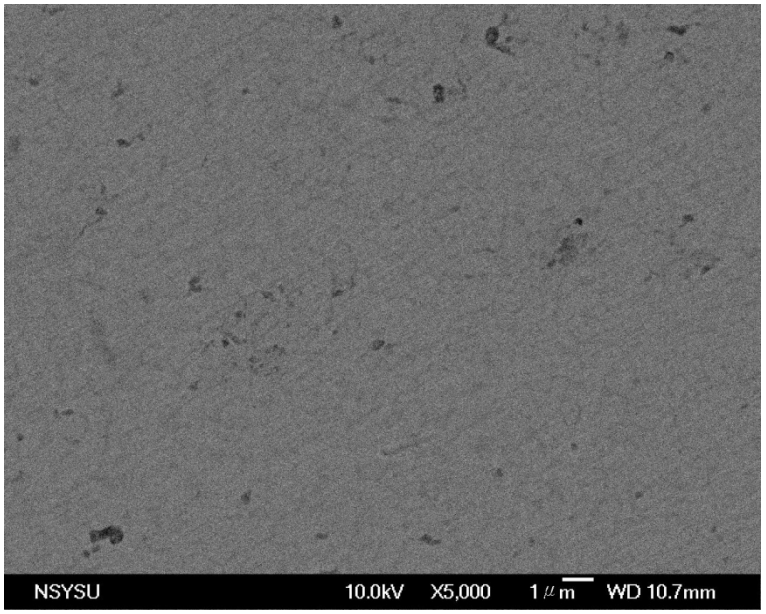


Mechanical properties

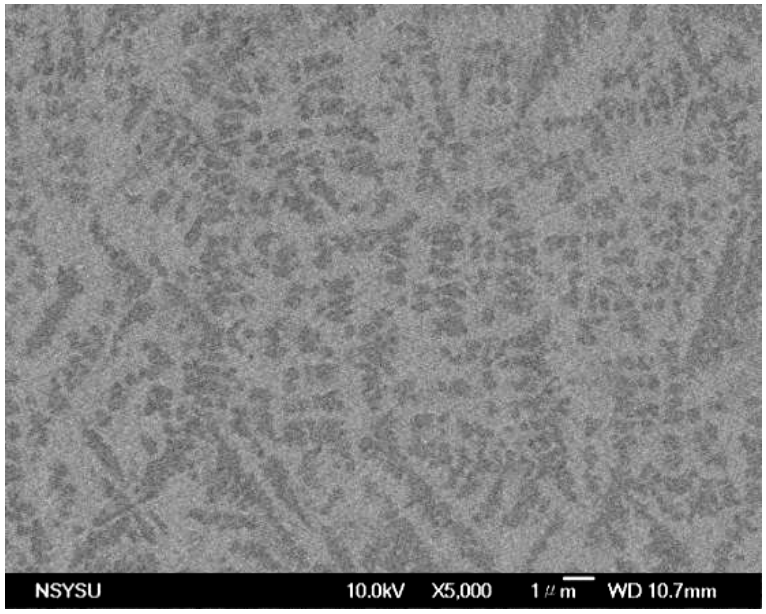




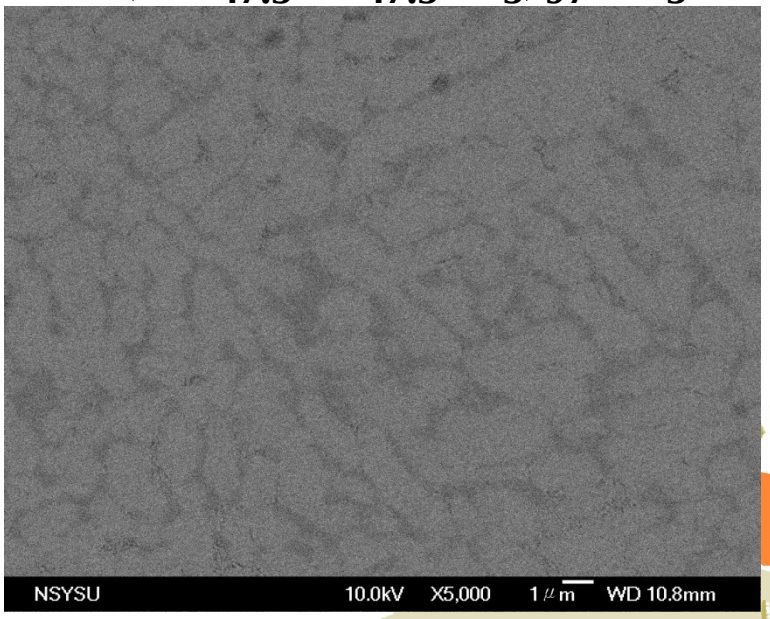
$(Cu_{47.5}Zr_{47.5}Al_5)_{97}V_3$



$(Cu_{47.5}Zr_{47.5}Al_5)_{97}Co_5$

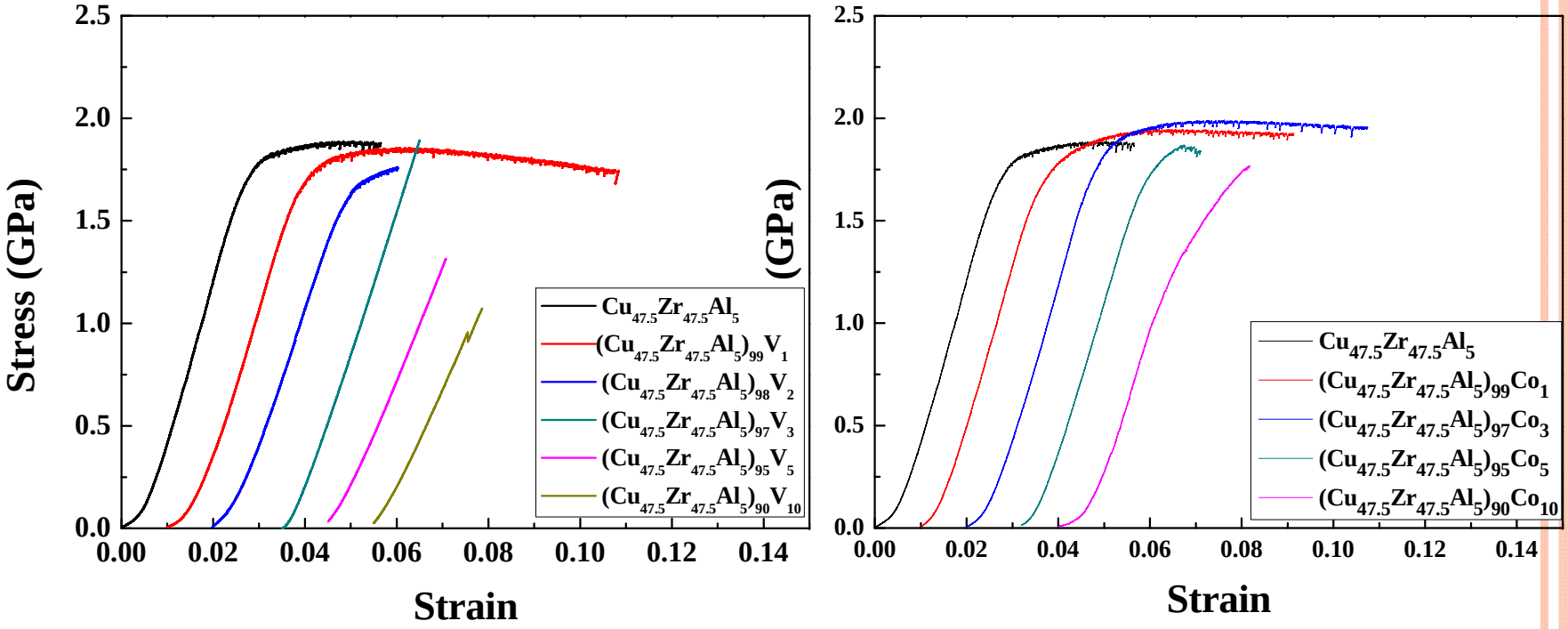


$(Cu_{47.5}Zr_{47.5}Al_5)_{90}V_{10}$



$(Cu_{47.5}Zr_{47.5}Al_5)_{90}Co_{10}$

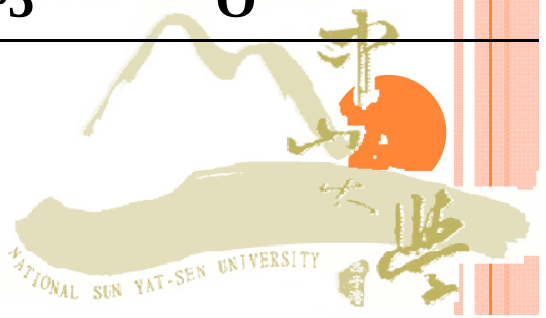
Compression results



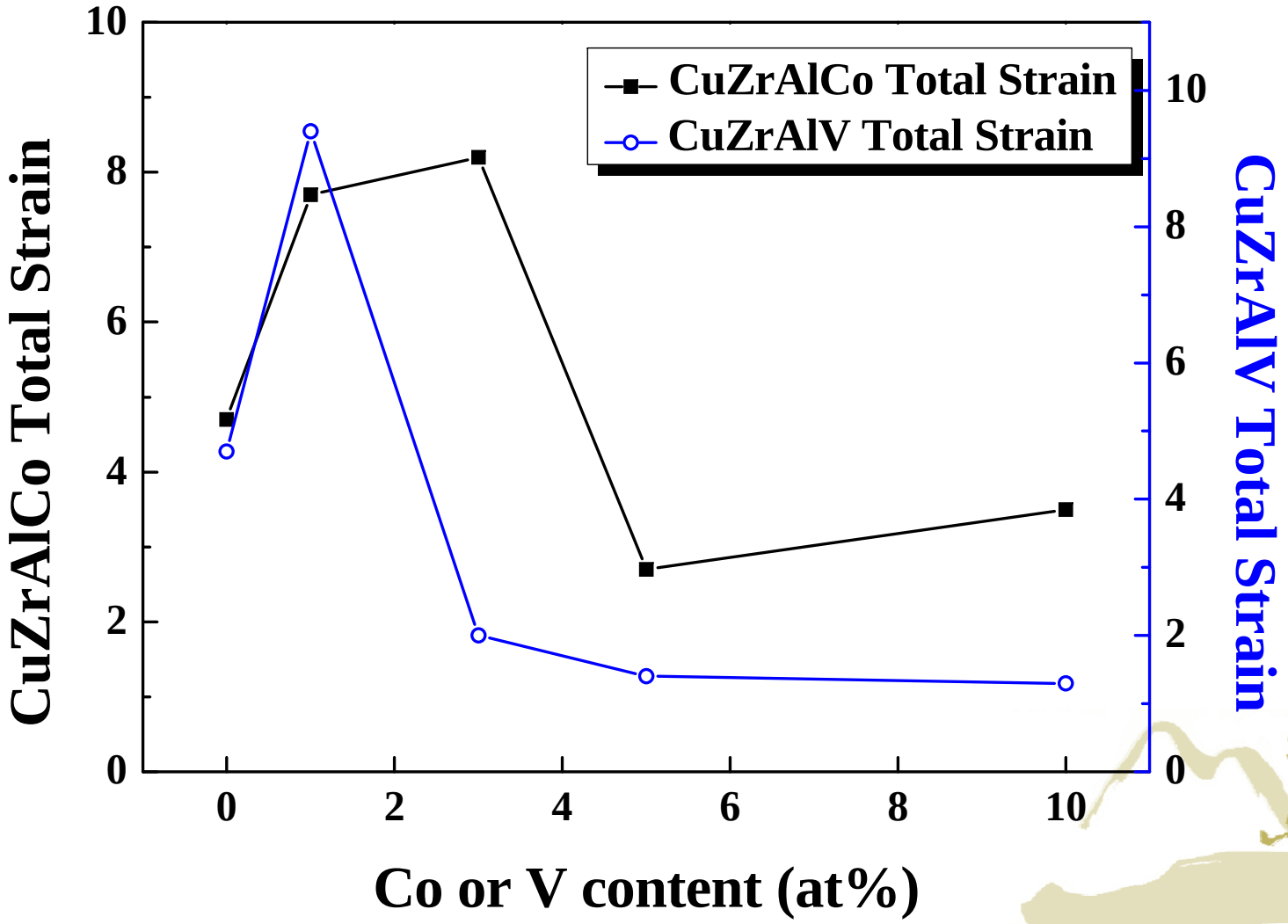
Mechanical properties

Composition	E (GPa)	σ_y (GPa)	ε_t (%)	D (μm)	Plastic	Hv
$Cu_{47.5}Zr_{47.5}Al_5$	90	1.88	4.7	X	O	486
$(Cu_{47.5}Zr_{47.5}Al_5)_{99}V_1$	90	1.85	9.4	0.1~0.2	O	518
$(Cu_{47.5}Zr_{47.5}Al_5)_{99}Co_1$	90	1.93	7.7	X	O	524
$(Cu_{47.5}Zr_{47.5}Al_5)_{97}V_3$	90	1.89	2.0	2~5	X	622
$(Cu_{47.5}Zr_{47.5}Al_5)_{97}Co_3$	91	1.98	8.2	submicron	O	
$(Cu_{47.5}Zr_{47.5}Al_5)_{95}V_5$	88	1.31	1.4	2~5	X	
$(Cu_{47.5}Zr_{47.5}Al_5)_{95}Co_5$	91	1.85	2.7	1~2	O	
$(Cu_{47.5}Zr_{47.5}Al_5)_{90}V_{10}$	86	1.07	1.3	2~5	X	
$(Cu_{47.5}Zr_{47.5}Al_5)_{90}Co_{10}$	91	1.32	3.5	2~5	O	

E: elastic modulus
σ_y: yielding strength
ε_t: total strain
D: precipitation size



Mechanical properties



Thank You