

# Supplementary Materials

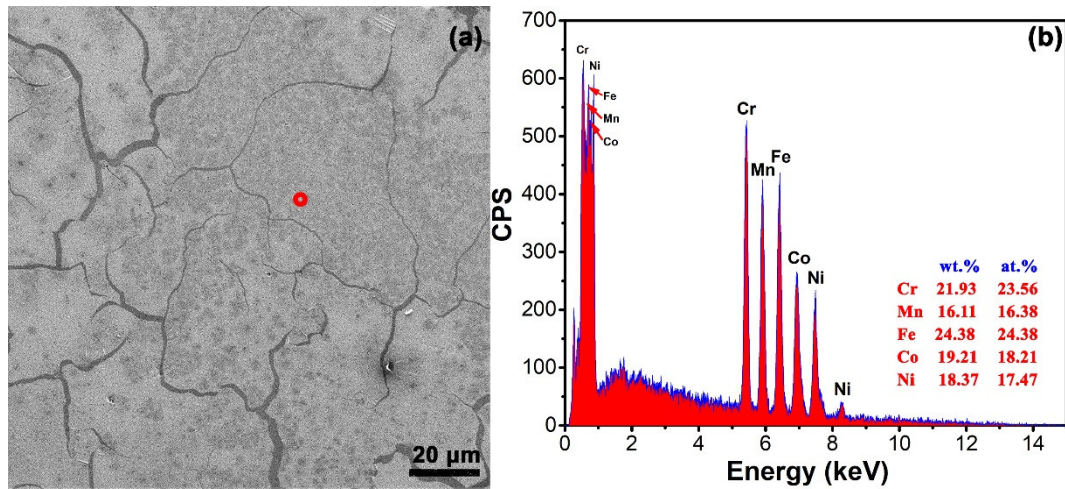


Figure S1. Microstructure of base (a) and EDS spectrum of position with marker (○) (b).

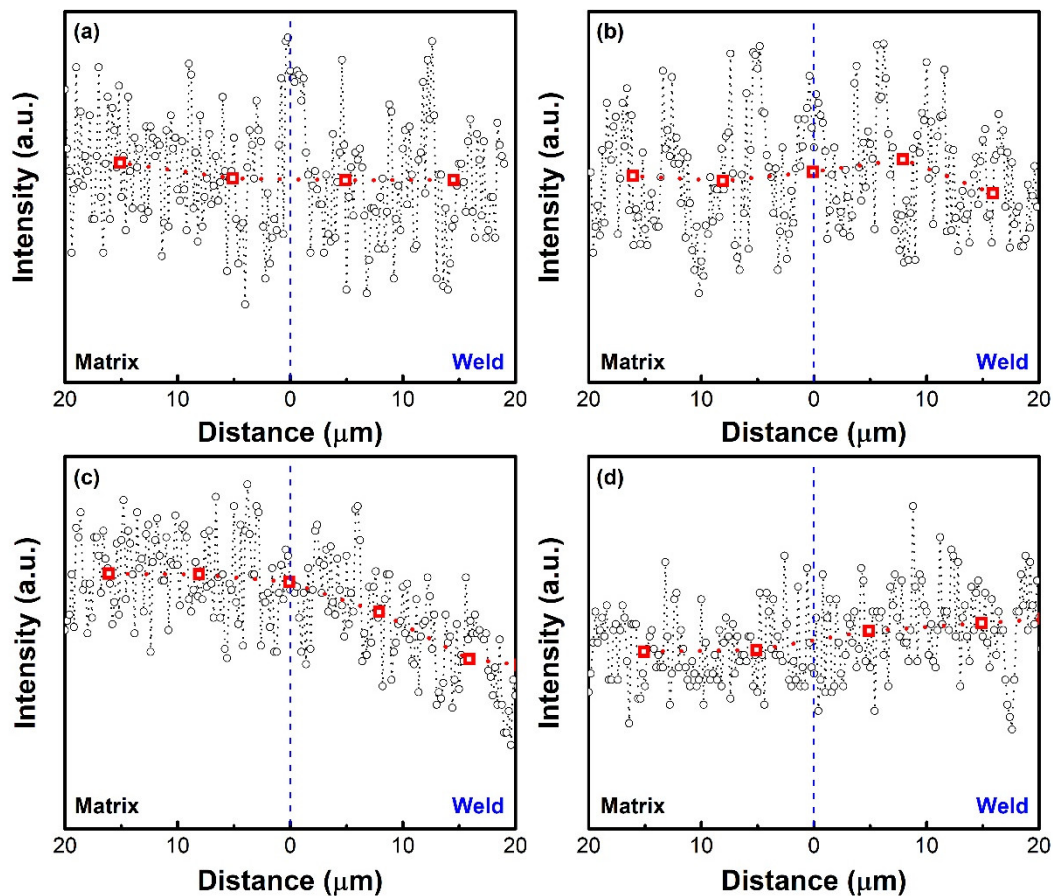
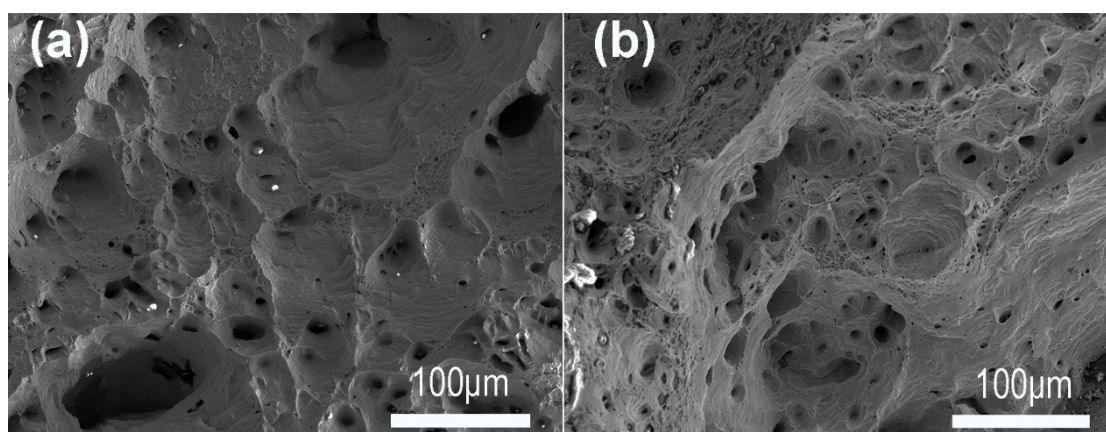


Figure S2. Compositional transition from matrix to weld of Mn element ((a) W1; (b) W2 and (c) W3) and that of Al element for W3 (d). (the scale “0” denotes the fusion line in each weld).



**Figure S3.** Fractographies contrast of base (a) and W1 (b).

**Table S1.** the tensile properties of base and weldments.

Sample	Yield Strength (MPa)	Ultimate Tensile Strength (MPa)	Elongation (%)	$\sigma_{UTS(weld)}/\sigma_{UTS(base)}$
Base	295.1	695.8	22.3	/
W1	303.1	610.9	19.5	87.8
W2	330.5	615.9	14.5	88.5
W3	317.6	566.8	15.8	81.5



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