Application Note EDXRF1978

View on rigaku.com

EDXRF1978 - Analysis of Alloy Powders for Metal 3D Printing

Scope

The analysis of alloy powders used for 3D printing is demonstrated.

Background

DMLS (Direct Metal Laser Sintering) is an industrial metal 3D printing method that fuses layers of fine metal powder particles, creating a metal part layer by layer. Metal 3D printing techniques are ideal for manufacturing complex metal shapes that can be expensive or impossible to produce using traditional manufacturing methods. Metal 3D printed parts are typically stronger and denser than those made by traditional casting. The DMLS process is used for prototyping metal parts and low volume manufacturing, eliminating expensive and time-consuming tooling. When mixing various metal alloy powders, it is important to monitor the elemental compositions of the raw materials and powder mixtures to ensure proper alloy balances for the parts being produced. Applied Rigaku Technologies offers the Rigaku NEX DE EDXRF spectrometer for fast and simple analysis of metal alloy powders used in metal 3D printing.

Analytical

Sample ID: Al-Si-Mg		
Component	**Result**	**Stat. error**
Mg	0.126	0.0071

Al	87.4	0.02
Si	12.2	0.0105
P	ND	0.0009
S	ND	0.0005
Cl	ND	0.0003
Ti	ND	0.0018
V	0.0111	0.0012
Cr	(0.0044)	0.0007
Mn	0.0038	0.0005
Fe	0.294	0.0016
Co	ND	0.0003
Ni	0.0081	0.0002
Cu	0.0045	0.0001
Zn	0.0033	<0.0001
Ga	0.0080	0.0001
Y	0.0002	<0.0001
Nb	(0.0002)	<0.0001
Mo	0.0010	<0.0001
Sn	(0.0002)	<0.0001
Pb	0.0009	<0.0001

Sample ID: Ti-Al- V		
Component	**Result**	**Stat. Error**
Mg	ND	0.0303
Al	4.49	0.0117
Si	ND	0.0011
P	ND	0.0006
S	ND	0.0003
Cl	ND	0.0003
Ti	90.6	0.0334
V	4.59	0.0153
Cr	ND	0.0060

Mn	(0.0046)	0.0013
Fe	0.238	0.0028
Co	ND	0.0006
Ni	0.0294	0.0007
Cu	0.0106	0.0004
Zn	(0.0012)	0.0002
Ga	0.0076	0.0002
Y	(0.0002)	<0.0001
Nb	0.0026	0.0002
Mo	0.0022	0.0002

Sample ID: PHSS		
Component	**Result**	**Stat. error**
Mg	ND	0.0097
Al	0.0247	0.0031
Si	0.528	0.0016
P	ND	0.0004
S	ND	0.0003
Cl	ND	0.0002
Ti	ND	0.0021
V	ND	0.0013
Cr	16.3	0.0208
Mn	(0.0252)	0.0067
Fe	75.6	0.0186
Co	0.202	0.0061
Ni	3.70	0.0107
Cu	3.16	0.0086
Zn	(0.0022)	0.0006
Ga	ND	0.0004
Y	ND	<0.0001
Nb	0.289	0.0019
Mo	0.0158	0.0005

Sample ID: 316LSS		
Component	**Result**	**Stat. error**
Mg	ND	0.0105
Al	0.125	0.0031
Si	0.480	0.0016
P	ND	0.0005
S	ND	0.0008
Cl	ND	0.0002
Ti	ND	0.0024
V	ND	0.0017
Cr	18.5	0.0240
Mn	0.938	0.0087
Fe	65.5	0.0237
Co	0.208	0.0065
Ni	11.8	0.0183
Cu	0.0905	0.0018
Zn	ND	0.0005
Ga	ND	0.0004
Y	ND	0.0001
Nb	ND	0.0004
Mo	2.39	0.0056

Sample ID: INC625		
Component	**Result**	**Stat. error**
Mg	ND	0.0130
Al	0.201	0.0039
Si	(0.0044)	0.0010
P	ND	0.0009
S	ND	0.0018
Cl	ND	0.0003
Ti	0.0741	0.0054
V	ND	0.0028

Cr	23.0	0.0380
Mn	ND	0.0087
Fe	0.326	0.0041
Co	ND	0.0021
Ni	63.1	0.0255
Cu	0.304	0.0030
Zn	0.0104	0.0011
Ga	ND	0.0007
Y	ND	0.0006
Nb	3.50	0.0072
Mo	9.44	0.0118

Sample ID: INC718		
Component	**Result**	**Stat. error**
Mg	ND	0.0123
Al	0.368	0.0040
Si	0.0465	0.0010
P	ND	0.0007
S	ND	0.0011
Cl	ND	0.0002
Ti	0.930	0.0101
V	ND	0.0035
Cr	20.0	0.0293
Mn	(0.0638)	0.0077
Fe	19.5	0.0246
Co	0.226	0.0054
Ni	50.7	0.0242
Cu	0.294	0.0029
Zn	ND	0.0088
Ga	ND	0.0006
Y	ND	0.0004
Nb	4.84	0.0082

Mo	3.14	0.0068

ND means the component was not detected; ( ) means the component was below LLQ.

Conclusion

This study illustrates how the NEX DE analyzer yields very good semi-quant results for general screening and monitoring alloy powder composition and mixtures. The Rigaku NEX DE analyzer, with its high performance and simple yet advanced software, provides an easy-to-use and valuable tool for the metal 3D printing industry to ensure proper alloy mixtures and high-quality metal parts.

Related products

NEX DE Series

High-power 60 kV EDXRF systems delivering speed, precisi
on, and small spot measurements