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Supplementary Materials

Evaluation of Refractory Metal Concentrations in Nano-Particulate Pressed-Powder Pellets Using LA-ICP-MS

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The chemical homogeneity of the powder-pressed pellets produced by different drying methods is evaluated through LA-ICP-MS spot analysis of refractory ore elements. W concentrations of the Mittersil ore (W ore) and Ta, Nb, and Sn of the Penouta ore (Ta ore) are presented in Tables S1-S4. The values are based on data normalized to CaO as an internal standard.

Table S1. Summary W concentrations (ppm) of the Mittersil ore pellets obtained by LA-ICP-MS spot analysis following pellet production using different drying techniques. The values are based on data normalized to CaO as an internal standard. SD=Standard deviation, rep=repeated analytical run.

Drying Method	Binder/Homogenization Time	1	2	Spots 3	4	5	Mean	SD
				W (ppm)				
Freeze-dried (FD)	No binder	1827.36	2033.08	1926.32	2044.46	1849.89	1936.22	100.62
	1 min	2550.26	2686.26	2712.88	2548.27	2445.85	2588.70	110.06
	5 min	2236.79	1778.94	2026.77	1842.62	2212.15	2019.45	208.29
	10 min	2835.95	2425.86	2422.31	2618.86	2420.69	2544.73	183.58
	No binder (rep)	1959.75	1986.91	2016.74	2015.47	2083.04	2012.38	45.93
Vacuum filtration with membrane (VDMF)	No binder	2102.4	2045.92	2001.52	2134.15	2132.11	2083.22	57.92
	1 min	2024.08	1840.99	2049.09	1960.5	2053.2	1985.57	88.91
	5 min	1740.51	1820.36	2020.09	2045.23	2064.17	1938.07	147.48
	No binder (rep)	1962.33	1953.01	1823.74	2078.72	1815.6	1926.68	109.56
Vacuum driven sterile filter (VDSF)	No binder	1638.12	1670.29	1633.7	1627.65	1686.36	1651.22	25.65
	1 min	1496.32	1566.67	1595.7	1584.48	1633.18	1575.27	50.41
	5 min	1571.82	1697.09	1706	1820.86	1746.58	1708.47	90.68
	10 min	1517.37	1510.2	1693.6	1584.42	1518.4	1564.80	78.04
Evaporation (E)	1 min	2249.54	2513.99	2286.89	2473.64	2531.15	2411.04	132.70
	5 min	2598.98	2539.2	2494.45	2569.58	3355.48	2711.54	362.05
	10 min	1871.63	2215.71	1986.07	1796.28	1943.13	1962.56	158.85
ICP-MS&ICP-AES reference value: 1967 ppm								

Table S2. Summary the Ta concentrations (ppm) of the Penouta ore pellets obtained by LA-ICP-MS spot analysis following pellet production using different drying techniques. The values are based on data normalized to CaO as an internal standard. SD=Standard deviation, rep=repeated analytical run.

	Binder/Homoge-nization Time	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
				Ta (ppm)				
Freeze-dried (FD)	No binder	86.56	70.07	99.96	79.60	100.90	87.42	13.25
	1 min	152.53	132.45	144.03	150.98	180.88	152.17	17.90
	5 min	89.07	109.21	90.52	101.62	124.50	102.98	14.60
	10 min	161.21	170.56	176.03	196.37	124.55	165.74	26.38
	No binder (rep)	91.39	81.30	93.75	99.14	119.73	97.06	14.23
Vacuum filtration with membrane (VDMF)	No binder	105.90	85.68	104.93	173.73	82.10	110.47	36.99
	1 min	94.27	102.70	92.02	175.98	114.16	115.83	34.73
	No binder (rep)	130.57	77.00	146.85	207.88	88.03	130.07	52.25
Vacuum driven sterile filter (VDSF)	1 min	73.26	78.32	80.11	89.79	78.56	80.01	6.05
	5 min	84.64	88.31	87.26	81.36	100.03	88.32	7.08
	10 min	73.44	70.37	78.03	71.72	71.10	72.93	3.07
Evaporation (E)	1 min	115.51	124.61	110.20	125.21	125.32	120.17	6.94
	5 min	72.15	91.73	78.54	142.97	95.28	96.13	27.83
	10 min	126.85	133.66	121.27	145.03	n.a.	131.70	10.23
ICP-MS&ICP-AES reference value: 97.3 ppm								

Table S3. Summary of the Nb concentrations (ppm) of the Penouta ore pellets obtained by LA-ICP-MS spot analysis following pellet production using different drying techniques. The values are based on data normalized to CaO as an internal standard. SD=Standard deviation, rep=repeated analytical run.

	Binder/Homoge-nization Time	**1**	**2**	**3**	**4**	**5**	**Mean**	**SD**
				Nb (ppm)				
Freeze-dried (FD)	No binder	83.38	61.97	85.00	64.76	90.86	77.19	12.96
	1 min	79.44	80.10	82.00	81.73	104.93	85.64	10.84
	5 min	70.44	68.54	60.25	69.94	79.16	69.67	6.72
	10 min	70.75	77.88	83.36	92.05	74.23	79.65	8.36
	No binder (rep)	74.88	72.81	75.18	76.88	95.37	79.02	9.25
Vacuum filtration with membrane (VDMF)	No binder	88.12	74.03	95.17	166.68	69.84	98.77	39.33
	1 min	66.27	101.57	65.75	90.63	93.45	83.53	16.49
	No binder (rep)	89.84	70.39	95.26	129.43	119.06	100.80	23.60
Vacuum driven sterile filter (VDSF)	1 min	69.94	69.83	73.24	75.41	71.55	71.99	2.36
	5 min	63.12	133.43	68.23	69.52	73.65	81.59	29.22
	10 min	65.4	65.71	66.92	63.83	65.48	65.47	1.10
Evaporation (E)	1 min	75.79	78.73	71.99	80.55	80.57	77.53	3.66
	5 min	59.32	93.42	59.41	152.97	66.67	86.36	39.79
	10 min	72.61	57.42	58.42	82.95	n.a.	67.85	12.23
ICP-MS&ICP-AES reference value: 58.2 ppm								

Table S4. Summary of the Sn concentrations (ppm) of the Penouta ore pellets obtained by LA-ICP-MS spot analysis following pellet production using different drying techniques. The values are based on data normalized to CaO as an internal standard. SD=Standard deviation, rep=repeated analytical run.

	Binder/Homogenization Time	**Spots 3**						
		1	**2**		**4**	**5**	**Mean**	**SD**
		Sn (ppm)						
Freeze-dried (FD)	No binder	303.18	278.58	356.71	241.96	286.66	293.42	41.88
	1 min	494.13	396.89	323.19	398.33	614.53	445.41	112.34
	5 min	279.45	242.60	257.97	279.19	288.86	269.61	18.87
	10 min	335.78	392.66	417.40	357.31	364.43	373.52	31.86
	No binder (rep)	253.53	256.51	253.61	242.81	265.92	254.48	8.26
Vacuum filtration with membrane (VDMF)	No binder	345.30	347.54	369.97	350.57	403.64	363.40	24.53
	1 min	406.30	312.92	434.97	339.16	472.76	393.22	66.35
	No binder (rep)	464.43	424.68	313.43	479.78	463.59	429.18	67.83
Vacuum driven sterile filter (VDSF)	1 min	327.35	265.62	317.03	302.39	282.52	298.98	25.13
	5 min	272.34	309.46	270.52	261.03	292.43	281.16	19.52
	10 min	275.16	261.70	273.22	276.03	270.37	271.30	5.79
Evaporation (E)	1 min	436.07	414.11	384.42	334.10	372.05	388.15	39.26
	5 min	292.70	367.44	282.22	340.44	296.17	315.79	36.47
	10 min	350.07	295.40	311.89	281.04	n.a.	309.60	29.78
ICP-MS&ICP-AES reference value: 329 ppm								