

Effects of MgO and Fe₂O₃ Addition for Upgrading the Refractory Characteristics of Magnesite Ore Mining Wastes/by-Products

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Table S1. The mineralogical content (wt.%) of examined mineral waste sample W12 with the addition of different percentages of MgO and Fe₂O₃ after their thermal treatment at 1300 °C for 120 min.

Sample (MgO wt.%)	Olivine (Forsterite)	Pyroxenes	Magnesioferrite	Periclase
0%Fe ₂ O ₃				
W12	66.5 ± 4.6	33.5 ± 2.4	--	--
W12 (5%)	84.2 ± 5.6	7.7 ± 0.9	8.1 ± 0.6	--
W12 (10%)	90.3 ± 6.4	--	8.6 ± 0.6	1.1
W12 (15%)	85.2 ± 5.7	--	8.2 ± 0.6	6.6 ± 0.6
0.5%Fe ₂ O ₃				
W12 (10%)	90.4 ± 6.2	--	8.4 ± 0.6	1.2 ± 0.1
W12 (15%)	85.2 ± 5.7	--	9.0 ± 0.6	5.8 ± 0.6
1%Fe ₂ O ₃				
W12(10%)	88.1 ± 6.0	--	8.8 ± 0.6	2.4 ± 0.3
W12(15%)	85.4 ± 5.7	--	9.1 ± 0.6	5.4 ± 0.6
2.5%Fe ₂ O ₃				
W12 (10%)	90.2 ± 6.2	--	9.8 ± 0.7	--
W12 (15%)	83.5 ± 5.5	--	10.8 ± 0.7	5.6 ± 0.6
5%Fe ₂ O ₃				
W12 (10%)	86.9 ± 5.9	-	13.1 ± 0.9	--
W12 (15%)	82.2 ± 5.5		13.0 ± 0.9	4.8 ± 0.7

Table S2. The mineralogical content (wt.%) of examined mineral waste sample W13 with different percentages of MgO and Fe₂O₃ after their thermal treatment at 1300 °C for 120 min.

Sample (MgO wt.%)	Olivine (Forsterite)	Pyroxenes (Enstatite/ Clinoenstatite)	Magnesioferrite	Periclase
0%Fe ₂ O ₃				
W13	60.3 ± 3.9	39.7 ± 3.9	--	--
W13 (5%)	74.8 ± 4.9	15.8 ± 1.4	9.4 ± 0.7	--
W13 (10%)	86.2 ± 5.8	6.7 ± 0.6	7.1 ± 0.6	--
W13 (15%)	90.2 ± 6.2	--	7.7 ± 0.6	2.1 ± 0.4
0.5%Fe ₂ O ₃				
W13 (10%)	81.8 ± 5.4	8.5 ± 0.9	9.7 ± 0.7	--
W13 (15%)	91.3 ± 6.3	--	7.7 ± 0.6	0.9 ± 0.2
1%Fe ₂ O ₃				
W13(10%)	82.2 ± 5.5	9.7 ± 1.1	8.1 ± 0.6	--
W13(15%)	89.0 ± 6.1	--	8.7 ± 0.6	2.4 ± 0.4
2.5%Fe ₂ O ₃				
W13 (10%)	81.7 ± 5.4	8.0 ± 0.9	10.4 ± 0.7	--
W13 (15%)	87.9 ± 6.0	--	10.1 ± 0.7	2.0 ± 0.4
5%Fe ₂ O ₃				
W13 (10%)	79.2 ± 5.2	8.5 ± 0.9	12.2 ± 0.8	--
W13 (15%)	87.3 ± 5.9	--	12.7 ± 0.9	--

Table S3. The mineralogical content (wt.%) of examined mineral waste sample W12 with the addition of different percentages of MgO and Fe₂O₃ after their thermal treatment at 1600 °C for 120 min.

Sample (MgO wt.%)	Olivine (Forsterite)	Pyroxenes (Clinoenstatite)	Magnesioferrite	Periclase
0%Fe ₂ O ₃				
W12	87.5 ± 5.9	10.3 ± 0.9	2.20 ± 0.2	--
W12 (5%)	96.6 ± 6.8	--	3.4 ± 0.3	--
W12 (10%)	93.3 ± 6.5	--	6.5 ± 0.5	--
W12 (15%)	87.3 ± 5.7	--	7.2 ± 0.5	5.5 ± 0.8
W12 (20%)	85.1 ± 5.7	--	6.7 ± 0.5	8.2 ± 0.7
0.5%Fe ₂ O ₃				
W12 (10%)	93.3 ± 6.5	--	6.7 ± 0.5	--
W12 (15%)	88.9 ± 6.1	--	7.1 ± 0.5	4.0 ± 1.0
W12 (20%)	83.8 ± 5.6	--	7.1 ± 0.5	9.1 ± 0.7
1%Fe ₂ O ₃				
W12(10%)	92.3 ± 6.4	--	7.7 ± 0.6	--
W12(15%)	88.5 ± 6.0	--	7.4 ± 0.5	4.1 ± 1.0
W12 (20%)	83.9 ± 5.6	--	7.9 ± 0.6	8.2 ± 2.7
2.5%Fe ₂ O ₃				
W12 (10%)	91.3 ± 6.3	--	8.7 ± 0.6	--
W12 (15%)	88.2 ± 6.0	--	7.9 ± 0.6	3.9 ± 0.9
W12 (20%)	83.9 ± 5.5	--	8.8 ± 0.6	8.4 ± 0.7
5%Fe ₂ O ₃				
W12 (10%)	90.0 ± 6.1	--	10.0 ± 0.7	--
W12 (15%)	85.8 ± 5.8	--	9.6 ± 0.7	4.7 ± 1.0
W12 (20%)	81.6 ± 5.4	--	10.2 ± 0.7	8.2 ± 0.7

Table S4. The mineralogical content (wt.%) of examined mineral waste sample W14 with the addition of different percentages of MgO and Fe₂O₃ after their thermal treatment at 1600 °C for 120 min.

Sample (MgO wt.%)	Olivine (Forsterite)	Pyroxenes (Clinoenstatite)	Magnesioferrite	Periclase
0%Fe ₂ O ₃				
W13	91.3 ± 6.3	4.4 ± 0.6	4.3 ± 0.4	--
W13 (5%)	91.1 ± 6.3	6.4 ± 0.7	2.5 ± 0.3	--
W13 (10%)	95.5 ± 6.8	--	4.5 ± 0.4	--
W13 (15%)	94.4 ± 6.6	--	5.6 ± 0.4	--
W13 (20%)	89.7 ± 6.1	--	6.4 ± 0.5	3.9 ± 0.4
1%Fe ₂ O ₃				
W13(10%)	95.0 ± 6.6	--	5.0 ± 0.5	--
W13(15%)	93.1 ± 6.5	--	6.9 ± 0.5	--
W13 (20%)	88.6 ± 6.0	--	8.1 ± 0.6	3.3 ± 0.4
2.5%Fe ₂ O ₃				
W13 (10%)	95.9 ± 6.7	--	4.1 ± 0.4	--
W13 (15%)	93.3 ± 6.5	--	6.7 ± 0.5	--
W13 (20%)	89.2 ± 6.1	--	6.8 ± 0.5	4.0 ± 0.5
5%Fe ₂ O ₃				
W13 (10%)	94.9 ± 6.7	--	5.1 ± 0.4	--
W13 (15%)	90.7 ± 6.2	--	9.3 ± 0.7	--
W13 (20%)	88.0 ± 6.0	--	8.5 ± 0.6	3.4 ± 0.4