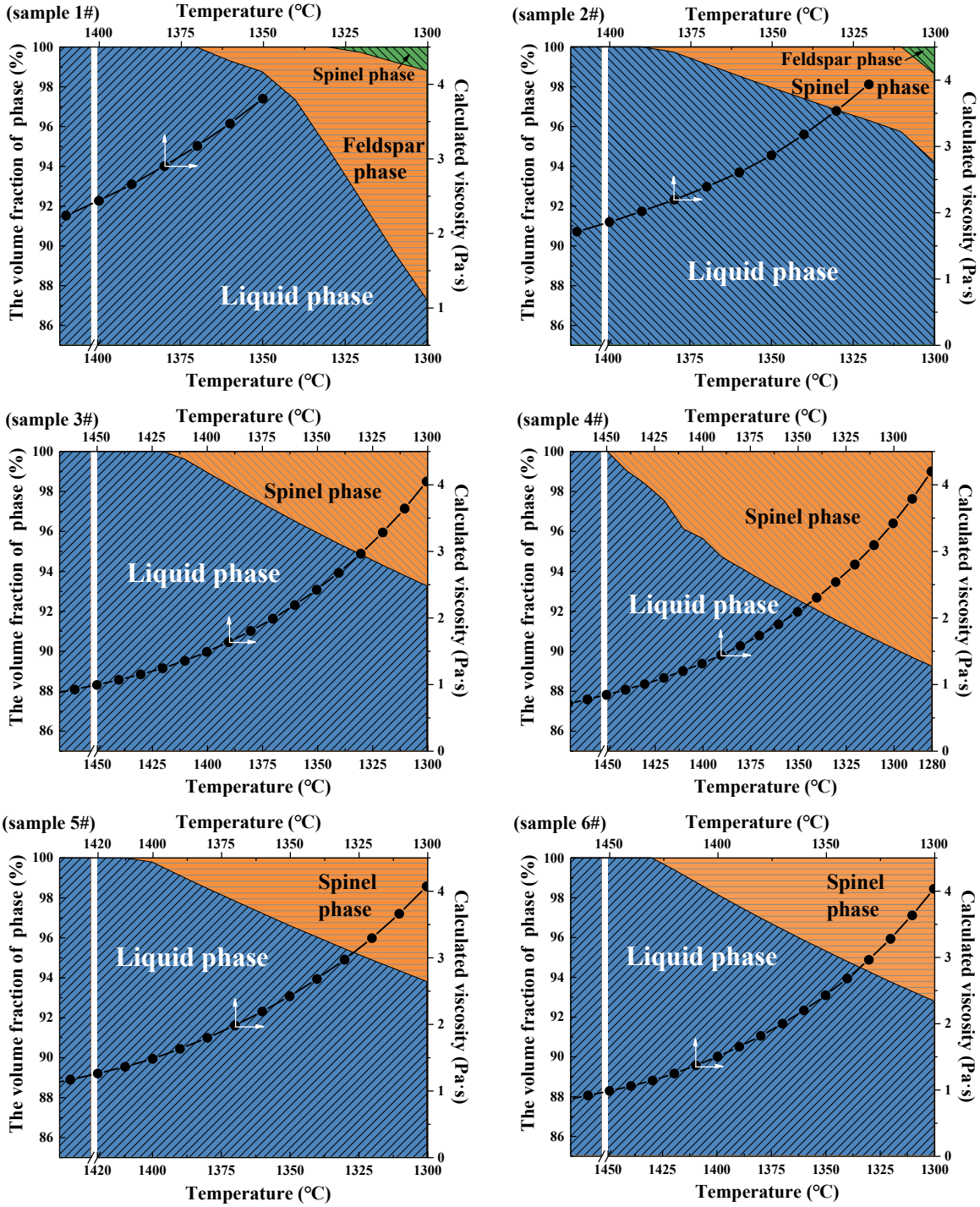
# Supplementary Materials: Effect of MgO and $K_2O$ on High–Al Silicon–Manganese Alloy Slag Viscosity and Structure

**Xiangdong Xing, Zhuogang Pang, Jianlu Zheng, Yueli Du and Shan Ren and Jiantao Ju**



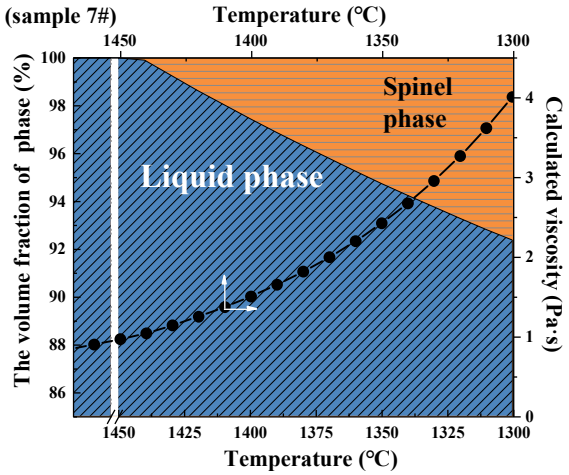



**Figure S1.** Relationship between the volume fraction of phases and calculated viscosity at different temperatures.

**Table S1.** Calculation results of the liquid and solid phase fractions of sample 1#.

| Sample 1# | Calculated Value: 1387 °C (Total Melted) | Measured Value: 1367 °C (Flowing Temperature) | |
|---|---|---|---|
| Temperature (°C) | Liquid Phase (%) | Solid Phase (%) | |
| | | Feldspar | Spinel |
| 1360 | 99.31 | 0.69 | 0 |
| 1350 | 98.76 | 1.24 | 0 |
| 1340 | 97.35 | 2.65 | 0 |
| 1330 | 94.89 | 5.11 | 0 |
| 1320 | 92.3 | 7.43 | 0.27 |
| 1310 | 89.67 | 9.57 | 0.76 |
| 1300 | 87.26 | 11.55 | 1.19 |

**Table S2.** Calculation results of the liquid and solid phase fractions of sample 2#.

| Sample 2# | Calculated Value: 1367 °C (Total Melted) | Measured Value: 1393 °C (Flowing Temperature) | |
|---|---|---|---|
| Temperature (°C) | Liquid Phase (%) | Solid Phase (%) | |
| | | Spinel | Feldspar |
| 1380 | 99.75 | 0.25 | 0 |
| 1370 | 99.14 | 0.86 | 0 |
| 1360 | 98.54 | 1.46 | 0 |
| 1350 | 97.96 | 2.04 | 0 |
| 1340 | 97.39 | 2.61 | 0 |
| 1330 | 96.83 | 3.17 | 0 |
| 1320 | 96.29 | 3.71 | 0 |
| 1310 | 95.71 | 4.29 | 0 |
| 1300 | 94.22 | 4.43 | 1.35 |

**Table S3.** Calculation results of the liquid and solid phase fractions of sample 3#.

| **Sample 3#** | **Calculated Value: 1416 °C (Total Melted)** | **Measured Value: 1408 °C (Flowing Temperature)** |
|---|---|---|
| **Temperature (°C)** | **Liquid Phase (%)** | **Solid Phase (%)** |
| 1410 | 99.6 | 0.4 (Spinel) |
| 1400 | 98.95 | 1.05 (Spinel) |
| 1390 | 98.32 | 1.68 (Spinel) |
| 1380 | 97.7 | 2.3 (Spinel) |
| 1370 | 97.1 | 2.9 (Spinel) |
| 1360 | 96.51 | 3.49 (Spinel) |
| 1350 | 95.93 | 4.06 (Spinel) |
| 1340 | 95.37 | 4.63 (Spinel) |
| 1330 | 94.83 | 5.17 (Spinel) |
| 1320 | 94.29 | 5.71 (Spinel) |
| 1310 | 93.77 | 6.23 (Spinel) |
| 1300 | 93.26 | 6.74 (Spinel) |

**Table S4.** Calculation results of the liquid and solid phase fractions of sample 4#.

| **Sample 4#** | **Calculated Value: 1442 °C (Total Melted)** | **Measured Value: 1428 °C (Flowing Temperature)** |
|---|---|---|
| **Temperature (°C)** | **Liquid Phase (%)** | **Solid Phase (%)** |
| 1440 | 99.04 | 0.96 (Spinel) |
| 1430 | 98.37 | 1.63 (Spinel) |
| 1420 | 97.53 | 2.47 (Spinel) |
| 1410 | 96.11 | 3.89 (Spinel) |
| 1400 | 95.64 | 4.36 (Spinel) |
| 1390 | 94.71 | 5.29 (Spinel) |
| 1380 | 94.15 | 5.85 (Spinel) |
| 1370 | 93.6 | 6.4 (Spinel) |
| 1360 | 93.07 | 6.93 (Spinel) |
| 1350 | 92.55 | 7.45 (Spinel) |
| 1340 | 92.04 | 7.96 (Spinel) |
| 1330 | 91.55 | 8.45 (Spinel) |
| 1320 | 91.06 | 8.94 (Spinel) |
| 1310 | 90.59 | 9.41 (Spinel) |
| 1300 | 90.13 | 9.87 (Spinel) |

**Table S5.** Calculation results of the liquid and solid phase fractions of sample 5#.

| **Sample 5#** | **Calculated Value: 1403 °C (Total Melted)** | **Measured Value: 1389 °C (Flowing Temperature)** |
|---|---|---|
| **Temperature (°C)** | **Liquid Phase (%)** | **Solid Phase (%)** |
| 1400 | 99.8 | 0.2 (Spinel) |
| 1390 | 99.13 | 0.87 (Spinel) |
| 1380 | 98.48 | 1.52 (Spinel) |
| 1370 | 97.85 | 2.15 (Spinel) |
| 1360 | 97.23 | 2.77 (Spinel) |
| 1350 | 96.62 | 3.38 (Spinel) |
| 1340 | 96.03 | 3.97 (Spinel) |
| 1330 | 95.45 | 4.55 (Spinel) |
| 1320 | 94.89 | 5.11 (Spinel) |
| 1310 | 94.34 | 5.66 (Spinel) |
| 1300 | 93.8 | 6.2 (Spinel) |

**Table S6.** Calculation results of the liquid and solid phase fractions of sample 6#.

| **Sample 6#** | **Calculated Value: 1428 °C (Total Melted)** | **Measured Value: 1417 °C (Flowing Temperature)** |
|---|---|---|
| **Temperature (°C)** | **Liquid Phase (%)** | **Solid Phase (%)** |
| 1420 | 99.43 | 0.57 (Spinel) |
| 1410 | 98.8 | 1.2 (Spinel) |
| 1400 | 98.18 | 1.82 (Spinel) |
| 1390 | 97.58 | 2.42 (Spinel) |
| 1380 | 96.99 | 3.01 (Spinel) |
| 1370 | 96.42 | 3.58 (Spinel) |
| 1360 | 95.86 | 4.14 (Spinel) |
| 1350 | 95.32 | 4.68 (Spinel) |
| 1340 | 94.79 | 5.21 (Spinel) |
| 1330 | 94.27 | 5.73 (Spinel) |
| 1320 | 93.76 | 6.24 (Spinel) |
| 1310 | 93.27 | 6.73 (Spinel) |
| 1300 | 92.78 | 7.22 (Spinel) |

**Table S7.** Calculation results of the liquid and solid phase fractions of sample 7#.

| **Sample 7#** | **Calculated Value: 1441 °C (Total Melted)** | **Measured Value: 1425 °C (Flowing Temperature)** |
|---|---|---|
| **Temperature (°C)** | **Liquid Phase (%)** | **Solid Phase (%)** |
| 1440 | 99.91 | 0.09 (Spinel) |
| 1430 | 99.27 | 0.73 (Spinel) |
| 1420 | 98.65 | 1.35 (Spinel) |
| 1410 | 98.05 | 1.95 (Spinel) |
| 1400 | 97.47 | 2.53 (Spinel) |
| 1390 | 96.89 | 3.11 (Spinel) |
| 1380 | 96.34 | 3.66 (Spinel) |
| 1370 | 95.8 | 4.2 (Spinel) |
| 1360 | 95.27 | 4.73 (Spinel) |
| 1350 | 94.75 | 5.25 (Spinel) |
| 1340 | 94.25 | 5.75 (Spinel) |
| 1330 | 93.76 | 6.24 (Spinel) |
| 1320 | 93.28 | 6.72 (Spinel) |
| 1310 | 92.81 | 7.19 (Spinel) |
| 1300 | 92.36 | 7.64 (Spinel) |