# Structural, electrical and photocatalytic properties of iron-containing soda-lime aluminosilicate glass and glass-ceramics

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**Table 1** $^{57}$Fe Mössbauer fitted parameters for room temperature analyses of as collected slag (not heat-treated), melted slag at 1400 °C; heat treated at 800 °C for 100 min; and samples with different $Fe_2O_3$ and basicity content and the modified salag melted at 1400 °C; heat treated at 800 °C for 100 min

| Sample | Species | $A$ (%) | $\delta$ (mm s$^{-1}$) | $\Delta$ (mm s$^{-1}$) | $\Gamma$ (mm s$^{-1}$) |
|---|---|---|---|---|---|
| F-18 | $Fe^{III}$ $T_d$ | 78.8 | $0.32_{\pm 0.01}$ | $0.77_{\pm 0.02}$ | $0.50_{\pm 0.02}$ |
| | $Fe^{III}$ $T_d$ | 21.2 | $0.26_{\pm 0.02}$ | $1.65_{\pm 0.07}$ | $0.45_{\pm 0.05}$ |
| F-12 | $Fe^{III}$ $T_d$ | 60.0 | $0.28_{\pm 0.01}$ | $1.00_{\pm 0.03}$ | $0.53_{\pm 0.04}$ |
| | $Fe^{III}$ $T_d$ | 40.0 | $0.24_{\pm 0.01}$ | $1.78_{\pm 0.05}$ | $0.54_{\pm 0.06}$ |
| F-6 (B-1.00) | $Fe^{III}$ $T_d$ | 58.1 | $0.21_{\pm 0.02}$ | $0.93_{\pm 0.07}$ | $0.50_{\pm 0.08}$ |
| | $Fe^{III}$ $T_d$ | 41.9 | $0.23_{\pm 0.02}$ | $1.67_{\pm 0.11}$ | $0.53_{\pm 0.11}$ |
| B-1.75 | $Fe^{III}$ $T_d$ | 50.0 | $0.19_{\pm 0.02}$ | $0.84_{\pm 0.05}$ | $0.39_{\pm 0.07}$ |
| | $Fe^{III}$ $T_d$ | 50.0 | $0.12_{\pm 0.03}$ | $1.73_{\pm 0.09}$ | $0.54_{\pm 0.12}$ |
| B-1.50 | $Fe^{III}$ $T_d$ | 76.4 | $0.14_{\pm 0.02}$ | $0.92_{\pm 0.04}$ | $0.56_{\pm 0.05}$ |
| | $Fe^{III}$ $T_d$ | 23.6 | $0.12_{\pm 0.03}$ | $1.88_{\pm 0.07}$ | $0.37_{\pm 0.08}$ |
| B-1.25 | $Fe^{III}$ $T_d$ | 58.9 | $0.20_{\pm 0.01}$ | $0.84_{\pm 0.03}$ | $0.48_{\pm 0.05}$ |
| | $Fe^{III}$ $T_d$ | 41.1 | $0.12_{\pm 0.02}$ | $1.88_{\pm 0.04}$ | $0.44_{\pm 0.06}$ |
| B-0.75 | $Fe^{III}$ $T_d$ | 60.6 | $0.25_{\pm 0.02}$ | $0.98_{\pm 0.07}$ | $0.51_{\pm 0.05}$ |
| | $Fe^{III}$ $T_d$ | 39.4 | $0.26_{\pm 0.02}$ | $1.61_{\pm 0.13}$ | $0.51_{\pm 0.12}$ |
| M-1.5 | $Fe^{III}$ $T_d$ | 53.8 | $0.26_{\pm 0.02}$ | $0.82_{\pm 0.06}$ | $0.51_{\pm 0.08}$ |
| | $Fe^{III}$ $T_d$ | 46.2 | $0.18_{\pm 0.02}$ | $1.78_{\pm 0.07}$ | $0.52_{\pm 0.10}$ |
| Melted slag | $Fe^{III}$ $O_h$ | 52.1 | $0.36_{\pm 0.01}$ | $0.60_{\pm 0.06}$ | $0.43_{\pm 0.06}$ |
| | $Fe^{III}$ $O_h$ | 47.9 | $0.35_{\pm 0.01}$ | $1.08_{\pm 0.09}$ | $0.51_{\pm 0.06}$ |
| As collected slag | $Fe^{II}$ $O_h$ | 70.2 | $1.01_{\pm 0.01}$ | $1.81_{\pm 0.02}$ | $0.47_{\pm 0.03}$ |
| | $Fe^{III}$ $O_h$ | 29.8 | $0.48_{\pm 0.06}$ | $1.32_{\pm 0.09}$ | $0.53_{\pm 0.09}$ |

$T_d$ tetrahedral, $O_h$ octahedral, $A$ absorption area, $\delta$ isomer shift, $\Delta$ quadrupole splitting, $\Gamma$ line width

**Table 2** XRF compositional analysis of combustible waste slag (weight %) collected July 2018 and nominal composition of the model slag B-1.50

| | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | CaO | $Na_2O$ | $TiO_2$ | MgO | $P_2O_5$ | $K_2O$ | MnO | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| As collected slag | 23.90 | 20.80 | 18.33 | 24.61 | 4.69 | 2.14 | 3.12 | 1.45 | 0.21 | 0.36 | 0.39 |
| B-1.5 | 27.6 | 20 | 6 | 41.4 | 5 | - | - | - | - | - | - |

**Table 3** DCconductivity at RT for the samples of basicity 0.75 to 1.75 and the modified slag heat-treated at 800 °C for 100 min

| Sample | $\sigma_{DC}$[a] / $(\Omega\ cm)^{-1}$ |
|---|---|
| B-0.75 | $2.2\times10^{-12}$ |
| B-1.00 | $3.2\times10^{-11}$ |
| B-1.25 | $7.0\times10^{-10}$ |
| B-1.50 | $2.2\times10^{-8}$ |
| B-1.75 | $6.5\times10^{-9}$ |
| M-1.50 | $5.6\times10^{-9}$ |

[a] DC conductivity obtained from equivalent circuit modeling.