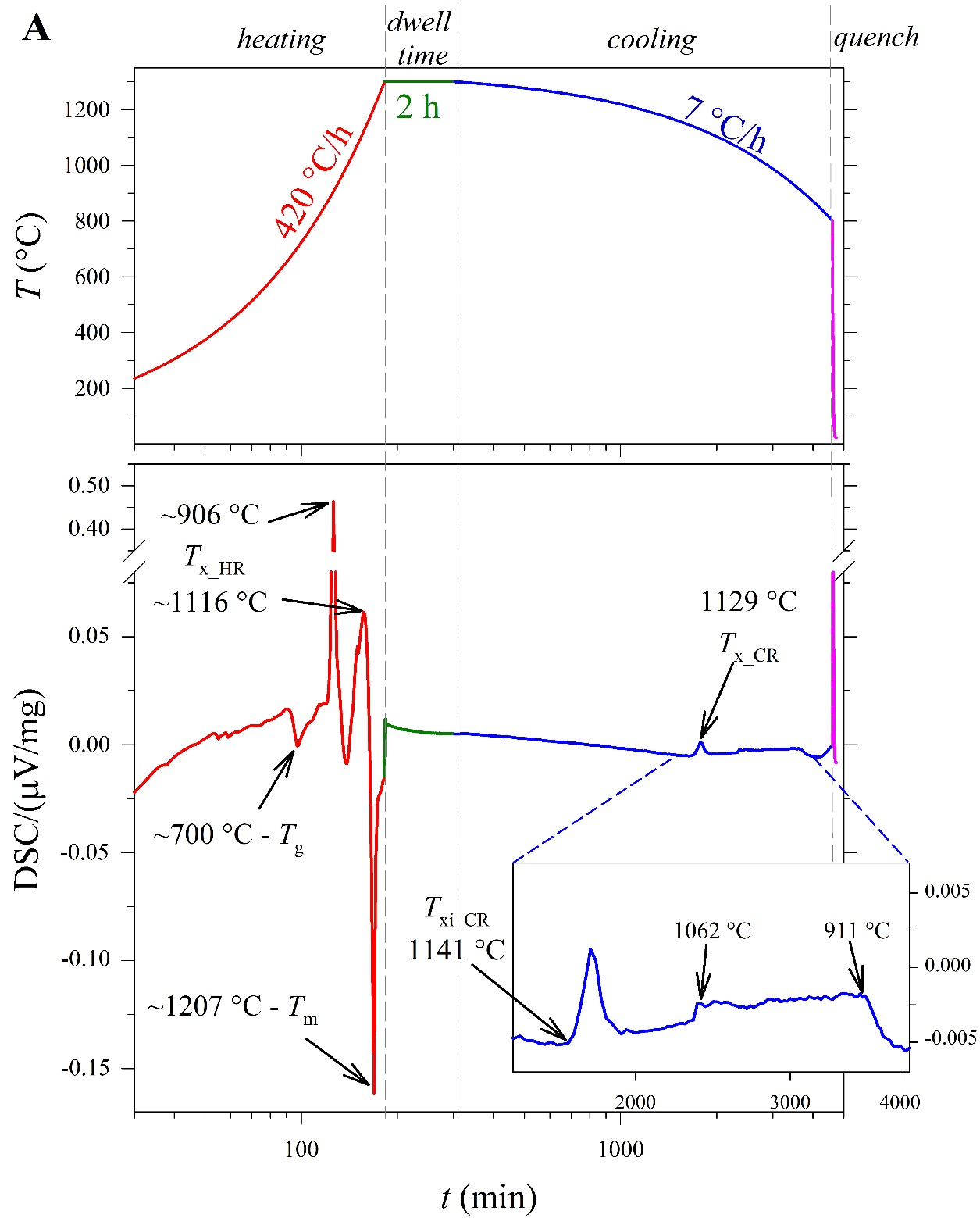
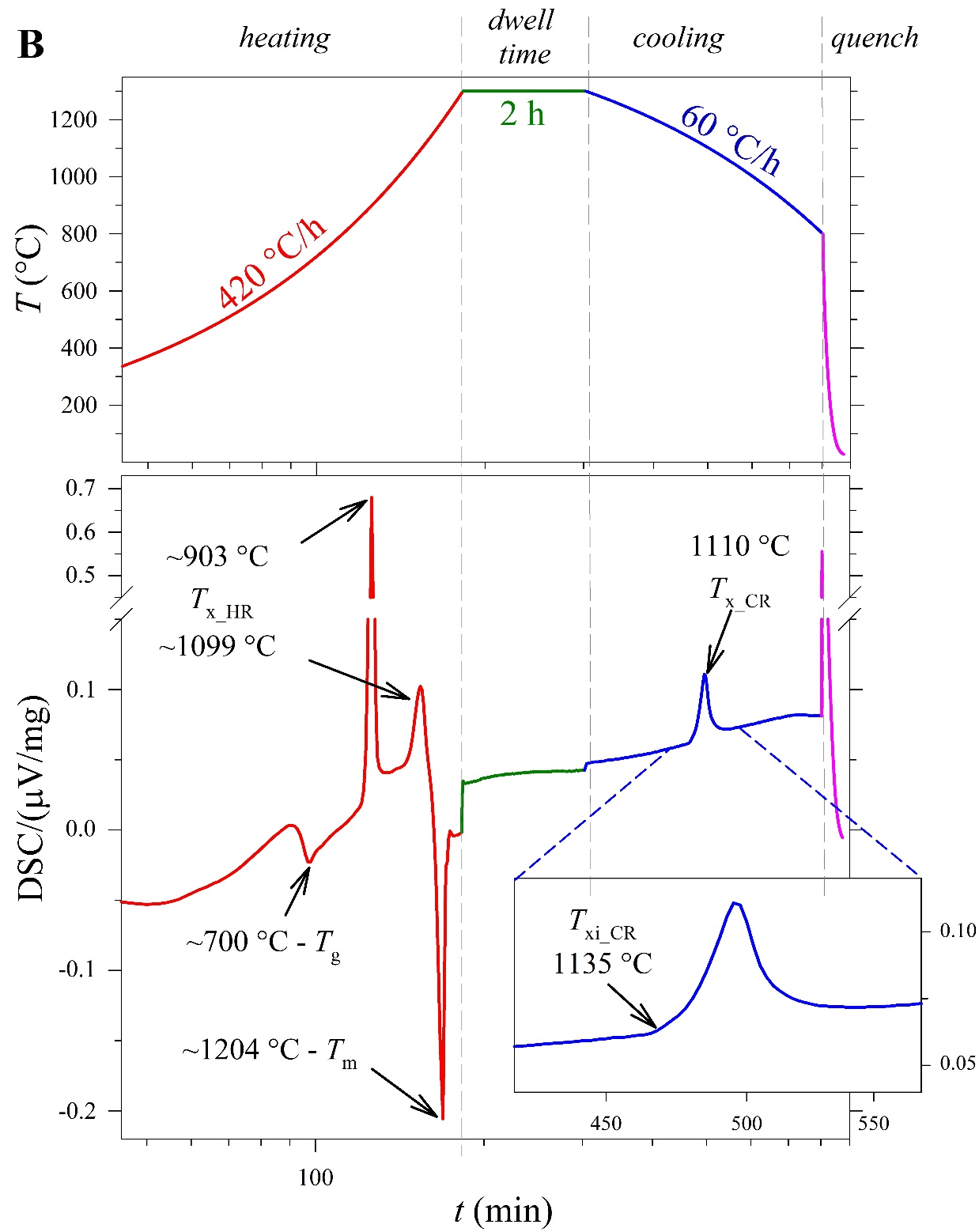
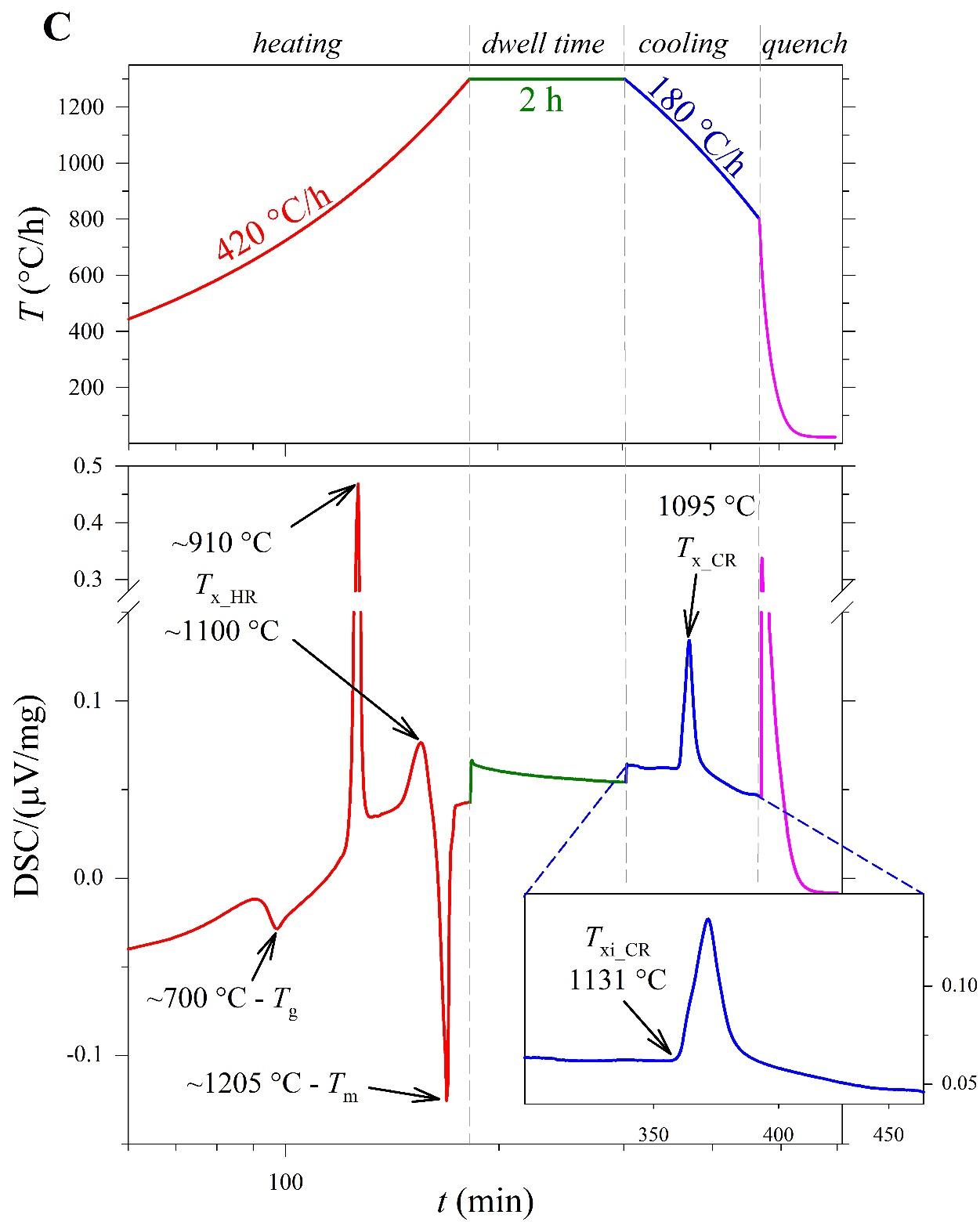
**Supplementary Figures**



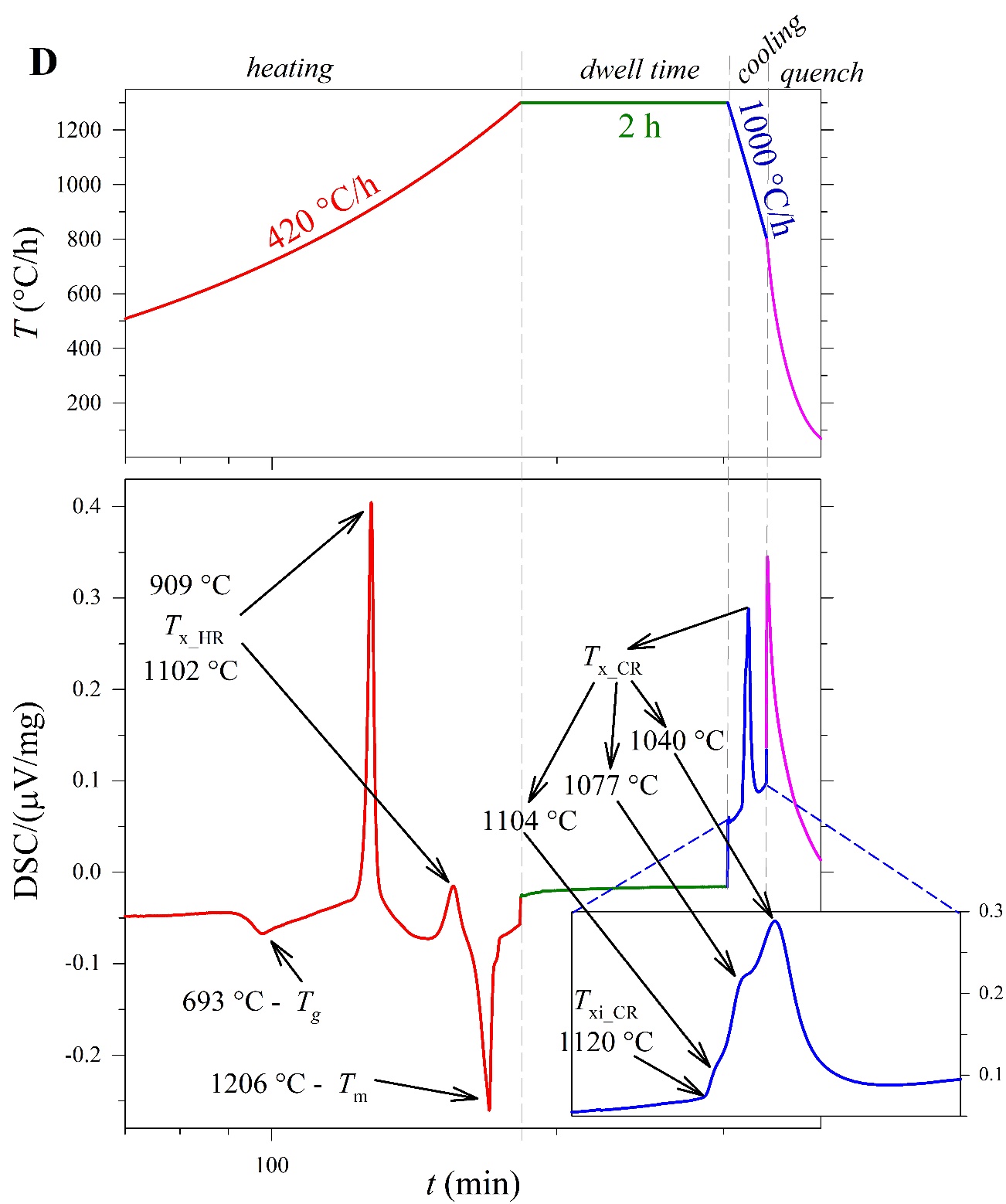
**Supplementary Figure 1(A)**.



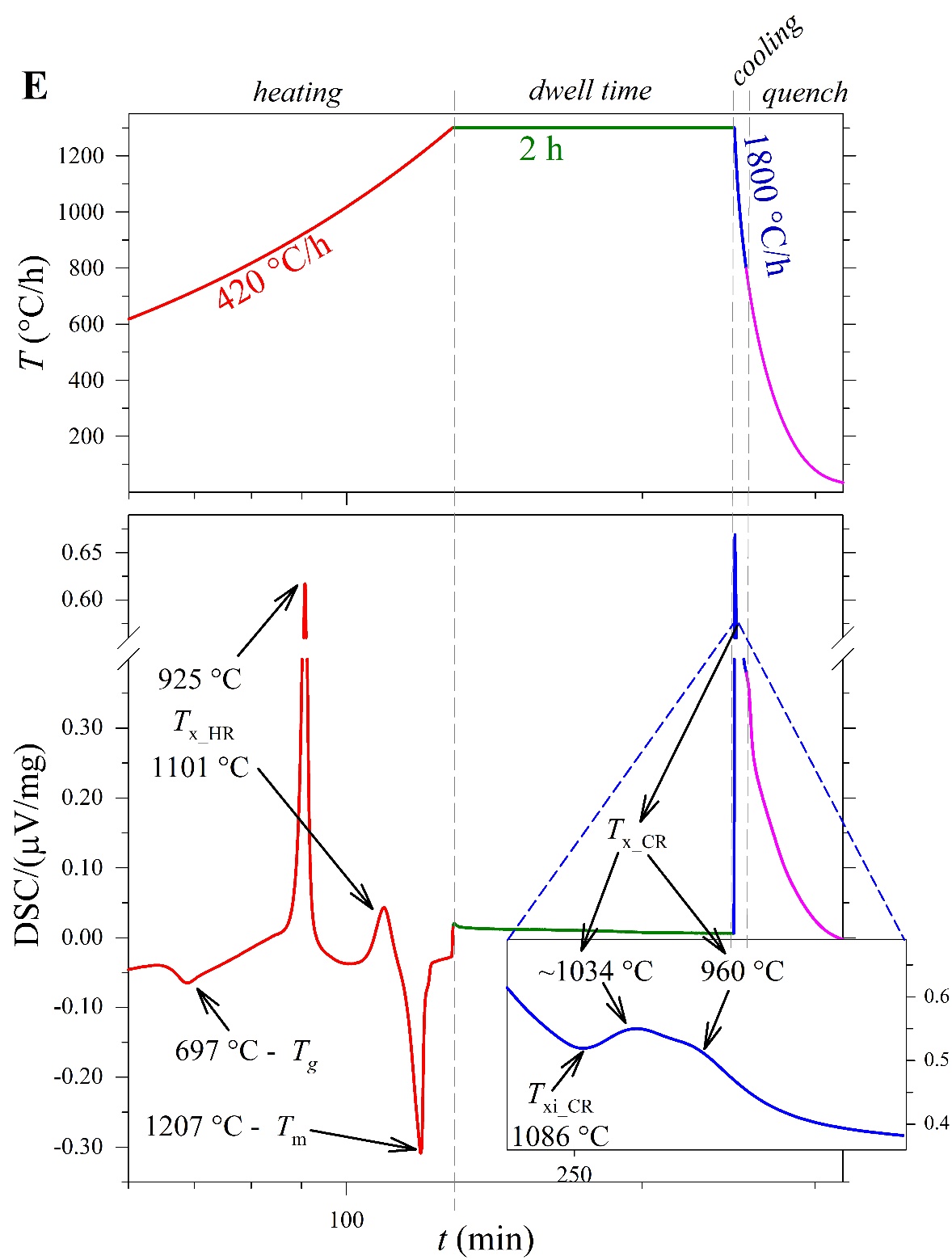
**Supplementary Figure 1(B)**.



**Supplementary Figure 1(C)**.



**Supplementary Figure 1(D)**.



**Supplementary Figure 1(E)**.

**Supplementary Figures 1(A-E)**. Thermal paths (top) and DSC spectra (bottom) for a MORB melt cooled at rates of 7 (A), 60 (B), 180 (C), 1000 (D), and 1800 (E) °C/h. DSC spectra relate the DSC signal based on the differential heat flux (DSC/(µV/mg)) and *T* (°C). Red curves; heating treatment from ambient temperature to 1300 °C at rate of 420 °C/h. Green curves; dwell time of 2 h at 1300 °C. Blue curves; cooling rate conditions. Pink curves; quench interval from 800 °C down to ambient temperature. Insert; zoom-in of the cooling path. **Glass transition temperature (*T*g), crystallization temperature (*T*x\_HR), and melting temperature (*T*m) were measured by *in-situ* DSC spectra acquired on heating. *T*x was also measured along the cooling path of the melt (*T*x\_CR). The temperature of the onset of crystallization (*T*xi) has been computed at 10% of the maximum intensity of the first crystallization peaks.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table 1S. Average compositions in wt.% determined by EPMA-WDS. | | | | | | |
| Δ*T*/Δ*t* (°C/h) | | 7 | 60 | 180 | 1000 | 1800 |
| # analytical point | | 20 | 16 | 20 | 20 | 20 |
| cpx | SiO2 | 43.9 (1.0) | 43.4 (0.5) | 45.4 (2.6) | 47.7 (0.5) | 47.0 (0.9) |
| TiO2 | 1.0 (0.2) | 0.9 (0.1) | 1.0 (0.1) | 1.0 (0.1) | 0.9 (0.1) |
| Al2O3 | 10.4 (0.3) | 11.0 (0.2) | 12.2 (1.8) | 15.5 (0.5) | 14.7 (1.2) |
| FeO | 10.2 (1.0) | 10.2 (0.6) | 10.1 (1.5) | 9.7 (0.5) | 10.2 (0.9) |
| Fe2O3 | 11.4 (1.1) | 11.3 (0.7) | 11.2 (1.7) | 10.8 (0.5) | 11.4 (1.0) |
| MgO | 13.1 (0.5) | 13.1 (0.7) | 12.1 (2.1) | 9.4 (0.6) | 10.2 (1.5) |
| CaO | 20.1 (0.7) | 19.4 (0.9) | 17.0 (1.7) | 13.5 (0.6) | 14.0 (1.5) |
| Na2O | 0.4 (0.0) | 0.5 (0.0) | 0.9 (0.6) | 1.9 (0.2) | 1.6 (0.4) |
| total (FeO) | 99.2 (0.6) | 98.5 (0.5) | 98.9 (0.5) | 98.9 (0.4) | 98.9 (0.6) |
| total (Fe2O3) | 100.3 (0.6) | 99.6 (0.5) | 100.0 (0.5) | 100.0 (0.4) | 100.0 (0.6) |
| # analytical point | | 20 | 14 | 6 | 9 | - |
| mel | SiO2 | 25.9 (3.4) | 29.7 (4.0) | 33.6 (4.7) | 39.1 (2.7) | - |
| TiO2 | 1.5 (0.1) | 1.5 (0.2) | 1.4 (0.2) | 1.2 (0.2) |
| Al2O3 | 16.2 (1.1) | 15.0 (0.4) | 12.8 (0.5) | 14.4 (0.5) |
| FeO | 26.6 (2.2) | 23.4 (2.9) | 22.0 (2.8) | 18.1 (2.0) |
| Fe2O3 | 29.6 (2.4) | 26.0 (3.2) | 24.4 (3.1) | 20.1 (2.2) |
| Cr2O3 | 0.1 (0.1) | 0.3 (0.2) | 0.2 (0.1) | 0.1 (0.0) |
| MgO | 15.4 (1.6) | 15.0 (1.3) | 14.2 (1.8) | 12.7 (0.9) |
| CaO | 11.1 (0.6) | 11.1 (0.5) | 11.0 (0.4) | 11.1 (0.5) |
| Na2O | 0.7 (0.3) | 0.9 (0.3) | 1.1 (0.4) | 1.6 (0.2) |
| total (FeO) | 97.5 (0.5) | 96.9 (0.9) | 96.4 (0.4) | 98.5 (0.7) |
| total (Fe2O3) | 100.5 (0.6) | 99.5 (1.1) | 98.9 (0.5) | 100.5 (0.6) |
| # analytical point | | 20 | 18 | 5 | - | 1 |
| sp | SiO2 | 0.3 (0.8) | 1.6 (3.5) | 2.8 (2.6) | - | 2.6 |
| TiO2 | 0.7 (0.1) | 0.6 (0.1) | 0.6 (0.1) | 0.4 |
| Al2O3 | 18.1 (4.0) | 15.4 (0.8) | 14.3 (0.6) | 14.2 |
| FeO | 55.8 (4.4) | 56.3 (2.9) | 58.6 (1.0) | 53.2 |
| Fe2O3 | 62.0 (4.9) | 62.5 (3.2) | 65.1 (1.1) | 59.1 |
| Cr2O3 | 1.5 (1.1) | 2.4 (1.4) | 2.2 (1.5) | 4.7 |
| MgO | 18.9 (0.6) | 17.3 (0.6) | 15.6 (0.8) | 17.6 |
| CaO | 0.2 (0.1) | 0.3 (0.2) | 0.8 (0.6) | 0.7 |
| Na2O | 0.1 (0.1) | 0.2 (0.3) | 0.3 (0.2) | 0.2 |
| total (FeO) | 95.6 (1.0) | 94.1 (1.4) | 95.2 (1.6) | 93.7 |
| total (Fe2O3) | 101.7 (0.8) | 100.3 (1.3) | 101.7 (1.6) | 99.6 |
| # analytical point | | 20 | 20 | 17 | 20 | 20 |
| glass | SiO2 | 60.2 (1.2) | 58.8 (1.3) | 55.9 (2.6) | 47.6 (0.5) | 47.9 (0.3) |
| TiO2 | 1.0 (0.1) | 0.9 (0.1) | 0.8 (0.1) | 1.0 (0.1) | 1.0 (0.1) |
| Al2O3 | 20.6 (0.6) | 20.4 (1.0) | 19.2 (1.9) | 15.5 (0.2) | 15.6 (0.2) |
| FeO | 2.9 (0.4) | 3.7 (0.6) | 5.6 (1.9) | 10.2 (0.2) | 10.2 (0.2) |
| Fe2O3 | 3.3 (0.5) | 4.1 (0.7) | 6.2 (2.1) | 11.4 (0.2) | 11.3 (0.2) |
| MgO | 2.9 (0.2) | 3.6 (0.7) | 4.6 (1.4) | 9.4 (0.1) | 9.4 (0.2) |
| CaO | 8.4 (0.5) | 8.9 (0.7) | 9.4 (1.6) | 13.1 (0.2)) | 13.1 (0.3) |
| Na2O | 3.6 (0.2) | 3.3 (0.3) | 3.2 (0.4) | 1.6 (0.1) | 1.4 (0.1) |
| total (FeO) | 99.8 (0.5) | 99.7 (0.5) | 99.0 (0.6) | 98.7 (0.6) | 98.7 (0.4) |
| total (Fe2O3) | 100.2 (0.5) | 100.1 (0.5) | 99.6 (0.6) | 99.8 (0.6) | 99.8 (0.4) |

Footnotes: the standard deviations are reported in parenthesis and Fe2O3 has been computed by FeO\*1.111. chemical data was selected by considering oxide totals between 99-101 wt.% for cpx and glass, 98-102 wt.% for mel and 97-103 wt.% for sp. Plg were not detectable because of their small crystal sizes.