**Table 1 Different mechanisms gained in literature**

|  |  |  |  |
| --- | --- | --- | --- |
| Investigator | Additive | Mechanism | Apparent Activation Energy (kJ/mol) |
| Ding20 | None | Early stage: nucleation/chemical reaction controlling  Late state: gas/solid diffusion controlling | 114  221 |
| Chak.21 | None | Low temperature: diffusion controlling  High temperature: nucleation controlling |  |
| Kekk.5 | None | unreacted core model with a gas/solid diffusion controlling mechanism | 224 |
| Murti.21 | None | Diffusion of oxygen | 57 |
| Lin Qin22 | None | Early stage: nucleation and growth controlling  Middle stage: phase boundary reaction  Late stage: diffusion | 270±10 |
| Ding16 | CaO | Early stage: nucleation/chemical reaction controlling  Late stage: diffusion of Cr controlling | 139~161  410 |
| Ding15 | SiO2 | Early stage: diffusion of ions controlling  Late stage: smelting of Cr controlling | 194  256 |
| Duong13 | SiO2 | Early stage: nucleation/chemical reaction controlling  Late stage: not sure |  |

**Table 2. EDS for different points in Fig. 6**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| point | | Contents (atom ratio, %) | | | |
| Fe | Cr | C | O |
| 5 min  (R=31.47%) | A | 29.41 | 23.33 | 34.38 | 12.88 |
| B | 1.19 | 24.01 | 16.97 | 57.83 |
| 15 min  (R=66.61%) | A | 25.10 | 74.90 | -- | -- |
| B | 11.82 | 32.36 | 44.12 | 11.70 |
| C | 12.46 | 37.07 | 50.52 | -- |
| D | 1.48 | 18.54 | 23.26 | 56.72 |
| E | 1.14 | 20.31 | 22.81 | 55.74 |

**Table3 Standard Gibbs free energies of some reactions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Equation |  |  |  |
| 1 | 3FeO+4C=Fe3C+3CO | -221341.7 | -245719.3 | -288592.3 |
| 2 | 3FeO+3C=3Fe+3CO | -212288.5 | -257912.5 | -303536.5 |
| 3 | 21Cr2O3+91C=14Cr3C2+63CO | 870572.9 | -166302.1 | -1203198.1 |
| 4 | 21Cr2O3+81C=14Cr7C3+63CO | 1016874.9 | -19184.1 | -1055243.1 |
| 5 | 21Cr2O3+81 Fe3C=14Cr7C3+243Fe+63CO | 1391310.1 | 437643.1 | -516023.9 |
| 6 | 21Cr2O3+63C=42Cr+63CO | 2292171.0 | 1271571.0 | 250971 |