**Supplementary data**

**The chemical mixing enthalpy ( ΔHmixij ; kJ/mol) of binary equiatomic alloys calculated by Miedema’s approach.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Element** | **Al** | **Cu** | **Cr** | **Fe** | **Mn** | **W** |
| **Al** | 0 | -1 | -10 | -11 | -19 | -2 |
| **Cu** |  | 0 | 12 | 13 | 4 | 22 |
| **Cr** |  |  | 0 | -1 | 2 | 1 |
| **Fe** |  |  |  | 0 | -2.9 | 0 |
| **Mn** |  |  |  |  | 0 | 6 |
| **W** |  |  |  |  |  | 0 |

**SEM (EDS) Composition of AlCuCrFeMnWx High entropy alloys**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **AlCuCrFeMnWx** | **Phase** | **Al** | **Cu** | **Cr** | **Fe** | **Mn** | **W** |
| **X=0** | Ordered AlFe  Sigma Phase  FeMn Phase | 32.34  3.88  11.13 | 14.12  23.13  10.18 | 8.13  56.18  7.14 | 30.88  6.13  35.12 | 13.12  5.89  40.78 | 0  0  0 |
| **X=0.05** | Ordered AlFe  Sigma Phase  FeMn Phase  BCC Phase | 31.24  4.18  12.10  16.17 | 12.52  22.13  11.19  12.19 | 7.13  55.58  8.84  10.89 | 31.68  7.13  33.12  12.89 | 12.12  4.83  41.68  16.67 | 3.12  2.78  4.89  34.78 |
| **X=0.1** | Ordered AlFe  Sigma Phase  FeMn Phase  BCC Phase | 32.44  6.18  12.11  15.17 | 13.12  22.13  11.10  12.19 | 8.10  55.58  8.84  10.80 | 30.78  6.13  30.12  11.89 | 12.12  4.86  40.61  16.87 | 6.10  5.79  7.80  36.58 |
| **X=0.5** | Ordered AlFe  Sigma Phase  FeMn Phase  BCC Phase | 30.44  6.18  10.11  14.17 | 13.12  21.13  11.10  12.19 | 6.10  50.58  8.88  10.80 | 30.78  6.13  29.12  10.89 | 12.12  4.86  37.01  14.27 | 10.10  10.79  11.80  38.58 |

**TEM (EDS) Composition of AlCuCrFeMnWx High entropy alloys**

