Supplementary Information for

**Enthalpies of formation of the solid solutions of Zr*x*Y0.5-*x*/2Ta0.5-*x*/2O2**

**(0 ≤ *x* ≤ 0.2 and 0.65 ≤ *x* ≤ 1)**

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XRD patterns with results of Rietveld refinement:



**FIG S1.** XRD pattern of sample Zr0.8Y0.1Ta0.1O2 heat treated at 1773 K in air including the results of the Rietveld refinement.



**FIG S2.** XRD pattern of sample Zr0.75Y0.125Ta0.125O2 heat treated at 1773 K in air including the results of the Rietveld refinement.



**FIG S3.** XRD pattern of sample Zr0.68Y0.16Ta0.16O2 heat treated at 1773 K in air including the results of the Rietveld refinement.



**FIG S4.** XRD pattern of sample Zr0.665Y0.1675Ta0.1675O2 heat treated at 1773 K in air including the results of the Rietveld refinement.



**FIG S5.** XRD pattern of sample Zr0.65Y0.175Ta0.175O2 heat treated at 1773 K in air including the results of the Rietveld refinement.



**FIG S6.** XRD pattern of sample Zr0.2Y0.4Ta0.4O2 heat treated at 1773 K in air including the results of the Rietveld refinement.



**FIG S7.** XRD pattern of sample Zr0.1Y0.45Ta0.45O2 heat treated at 1773 K in air including the results of the Rietveld refinement.



**FIG S8.** XRD pattern of sample Zr0.0Y0.5Ta0.5O2 heat treated at 1253 K in air including the results of the Rietveld refinement.



**FIG S9.** XRD pattern of sample Zr0.0Y0.5Ta0.5O2 heat treated at 1773 K in air including the results of the Rietveld refinement.

Chemical composition measured by EPMA:

**Table S1.** Measured chemical composition of the compositions in the ZrO2 – Y0.5Ta0.5O2 quasibinary. The error is two standard deviation of the mean.

|  |  |
| --- | --- |
| **Nominal stoichiometry** | **Measured data (at%)** |
| **Zr** | **Y** | **Ta** | **O** |
| Zr0.8Y0.1Ta0.1O2 | 27.9 ± 1.2 | 3.3 ± 0.2 | 3.3 ± 0.2 | 65.5 ± 1.3 |
| Zr0.75Y0.125Ta0.125O2 | 26.6 ± 0.7 | 4.1 ± 0.2 | 3.9 ± 0.2 | 65.4 ± 0.9 |
| Zr0.68Y0.16Ta0.16O2 | 24.5 ± 0.3 | 5.3 ± 0.1 | 5.4 ± 0.1 | 64.8 ± 0.3 |
| Zr0.665Y0.1675Ta0.1675O2 | 23.9 ± 0.5 | 5.6 ± 0.1 | 5.7 ± 0.1 | 64.8 ± 0.5 |
| Zr0.65Y0.175Ta0.175O2 | 23.6 ± 0.4 | 6.0 ± 0.1 | 6.1 ± 0.1 | 64.3 ± 0.5 |
| Zr0.2Y0.4Ta0.4O2 | 6.7 ± 0.4 | 14.0 ± 0.3 | 14.1 ± 0.1 | 65.2 ± 0.2 |
| Zr0.1Y0.45Ta0.45O2 | 3.8 ± 0.2 | 15.4 ± 0.2 | 15.2 ± 0.2 | 65.6 ± 0.3 |
| Zr0Y0.5Ta0.5O2 | 0 | 17.4 ± 0.2 | 17.1 ± 0.6 | 65.5 ± 0.7 |