**Supplementary materials**

Modifying chemical composition of the fine Ni4Nb2O9 powders

using chloride melts as reaction medium

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**Figure S1.** X-ray diffraction pattern of the stoichiometric 4NiO-Nb2O5 powder mixture after

the fourth annealing at 1350oC for one hour.

F:\paper Ni4Nb2O9+CoCl2 2017\MS paper-2019\New paper version-14.06.2019\Fig S2.tif

**Figure S2.**  DSC and TG curves for KCl-CoCl2 reaction mixture (**▬** test No. 1, **▬** test No. 2).



**Figure S3.** Chemical reactor: 1- stopper; 2- quartz tube; 3- gas-feed tube; 4- thermocouple;

5- electrical oven; 6- KCl-CoCl2 melt; 7- Ni4Nb2O9 powder.



**Figure S4.** SEM micrographs of the Ni4Nb2O9 powders modified under argon (a)

and air atmosphere (b).



**Figure S5.** SEM micrographs of the Ni4Nb2O9 powders modified under argon (a) and air atmosphere (b) with a larger viewing area.

**Table S1.** The Raman spectra bands parameters in initial and modified Ni4Nb2O9 powders.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sample | Band position  cm-1 | FWHM  cm-1 | Relative intensity  arb. unit | C/B | A/B |
| initial Ni4Nb2O9 | 837  754  693 | 41  -  27 | 23781 A  433 B  7092 C | 16,38 | 54,92 |
| modified Ni4Nb2O9 | 836  755  693 | 45  49  29 | 4648 A  699 B  1523 C | 2,18 | 6,65 |

**Table S2.** Elemental composition (atomic %) of the modified Ni4Nb2O9 powders according to the results of the energy-dispersive X-ray spectroscopy (EDS)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test number | Oxygen / at % | Cobalt / at % | Nickel / at % | Niobium / at % |
| Ni4Nb2O9 powder modified under argon atmosphere | | | | |
| 1 | 67.16 | 11.31 | 10.23 | 11.29 |
| 2 | 62.08 | 6.27 | 16.66 | 13.88 |
| 3 | 69.53 | 7.31 | 10.76 | 9.72 |
| 4 | 65.59 | 10.92 | 10.45 | 12.43 |
| Ni4Nb2O9 powder modified under air atmosphere | | | | |
| 1 | 74.42 | 5.16 | 9.39 | 10.57 |
| 2 | 61.22 | 7.37 | 17.29 | 14.12 |
| 3 | 73.88 | 3.51 | 11.10 | 11.51 |
| 4 | 73.84 | 5.09 | 10.39 | 10.68 |