Ceria High Temperature and High Pressure Series After Cleaning with O2

Date: 2023-02-14
Tags: DRIFTS | CO | high pressure | CeO2 powder | High temperature
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Goal :

To investigate polycrystalline ceria at high pressures and high temperature after cleaning with O_2

Procedure :

LC0039.0 - in Ar atmosphere
LC0039.1 - in Ar atmosphere, sample was blown away, new calibration

LC0039.0000-0004 - 8 scan test, in Ar
LC0039.0005-0009 - 8 scan test, in O_2

Heat to 1000 °C, keep it for 2 hours, to reduce water content. Start 10:36 (T = 753 °C, shown)

LC0039.0010-0014, at 1000 (776) in O_2

stop heating 12:35

LC0039.0015-0019, after heating, high T
LC0039.0020-0024, after heating, 30 °C in O_2

start CO dosing, 200 ml/min, atm.

LC0039.0025-0525, 0.1 bar, first, put through bypass to reduce pressure (0.1 bar = ~90 ml/min)
LC0039.0526-0529, 0.1 bar, 512 scans, only loss of CO and gaining of OH + carbonate stuff

LC0039.0530-0650, in Ar look at depletion/el transtion
LC0039.0650-1150, in O2 look at depletion/el transtion
LC0039.1151-1170, in O2 look at depletion/el transtion, 256 scans

Idea:

2154 Ce4+
2176 Ce3+

2162 Ce4+ with OH
2188 Ce3+ with OH

Initial

immediate reduction even at rt, due to cleaned surface (no OH for CO reaction)

2156
2176

after time

2156->2162 Ce+4 with OH/coverage effect

gaining 2174 -> additional 2120ish -> Ce3+ with el transition
gaining 2185 -> Ce3+ with OH -> gaining small amounts 3617/3610 -> some type of OH

Results :

Several possible bands that may arise due to neighboring effects from OH groups and carbonates as well as others that are CO isolated on ceria Ce^{4+} and Ce^{3+}

(Data saved - DRIFTS PC; Folder – Data --> L Caulfield; File name - 20230214_CeO2_HighT_O2_pressure_series_newTube)

Unique eLabID: 20230704-eb7b7aba550c6cfb05425df499c3df72bc64509d
Link: https://ifgselabftw.ifg.kit.edu/experiments.php?mode=view&id=2268