Mixed Ionic and Electronic Conductors as Cathodes for the Reduction of NO.

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**Introduction:** Unsolved problems still remains for the purification of exhaust gasses from Diesel engines. One of the problems is the removal of $NO_x$. This cannot be done with the conventional 3way catalytic converter due to excess oxygen in the exhaust gas [1]. Various solutions are under the development among them the selectively catalytic reduction (SCR) of $NO_x$ with a reducing agent [2]. An alternative solution to the lean $DeNO_x$ problem is to reduce the $NO_x$ in an all solid-state electrochemical reactor. This has been tried and the major problem is the simultaneously reduction of oxygen at the cathode leading to a high current consumption [3]. New cathode materials with a high selectivity towards the reduction of $NO_x$ must therefore be developed. In this paper various LSM and LSFM perovskites are investigated as cathodes for the reduction of nitric oxide and oxygen in the temperature interval 300-500$^o$C.

**Experimental:** Synthesis of the perovskites compounds is done with the citric acid route. The powders are calcined at 1100$^o$C/6h before XRD are recorded. Cylinders of the perovskites are made by mixing the powers with a PVA solution before pressing in an appropriate die. The cylinders are sintered at 1150 to 1250$^o$C/12h before being machined into cones by the use of diamond tools. The electrolyte used is CGO10, and as a counter/reference electrode a silver paste is used.

**Results and Discussion:** Selected results for the reduction of nitric oxide and oxygen on cone shaped electrodes can be found in figure 1-3. It is seen that the reduction of nitric oxide is strongly dependent on the composition of the cathode materials, whereas only a slight variation in the activity towards the reduction of oxygen is found for the LSFM perovskites. Thermo gravimetric studies of the perovskite compound reveals that only the LSFM perovskites with a high iron content and the LSM perovskites with a low strontium content is redox active. The activity for the reduction of nitric oxide seems therefore to depend on both the redox activity and the amount of oxygen vacancies in the perovskite structure.

**Conclusion:** The activity for the reduction of oxygen is mainly determined by the amount of oxygen vacancies, whereas the activity for the reduction of nitric oxide is determined by both the redox activity and the amount of oxygen vacancies.

**References:**

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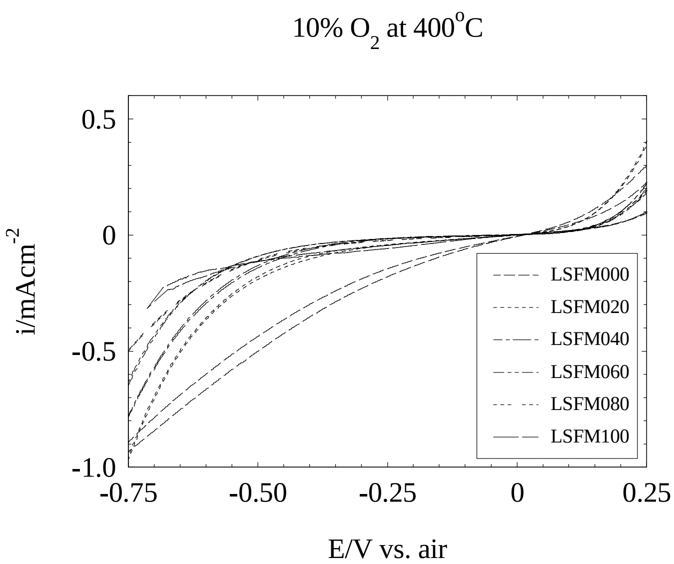


Fig. 1. Reduction of oxygen on LSFM-compounds.

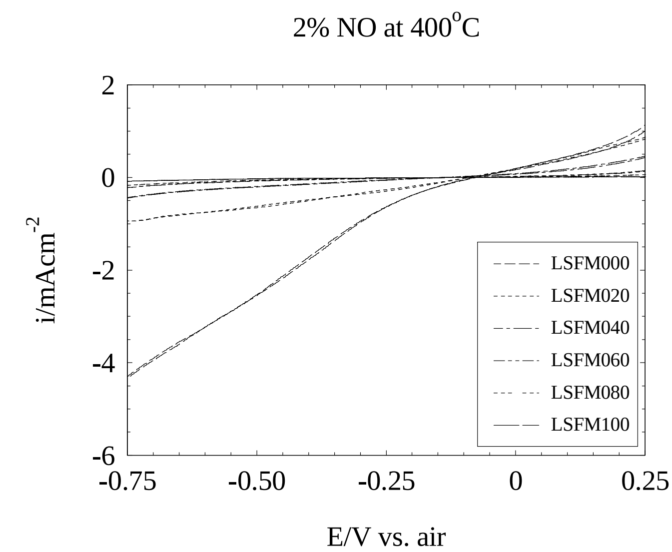


Fig. 2. Reduction of nitric oxide on LSFM-compounds.

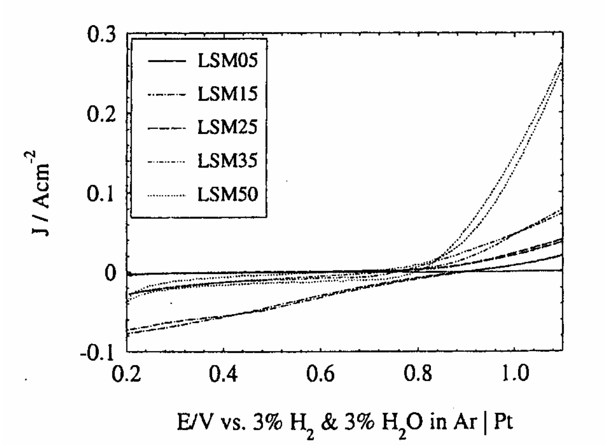


Fig. 3. Reduction of nitric oxide on LSM-compounds.