

Fig. 1. X-ray diffraction patterns of Mn(Fe)-Co-Al hydrotalcite-like compounds; H – hydrotalcite-like phase.

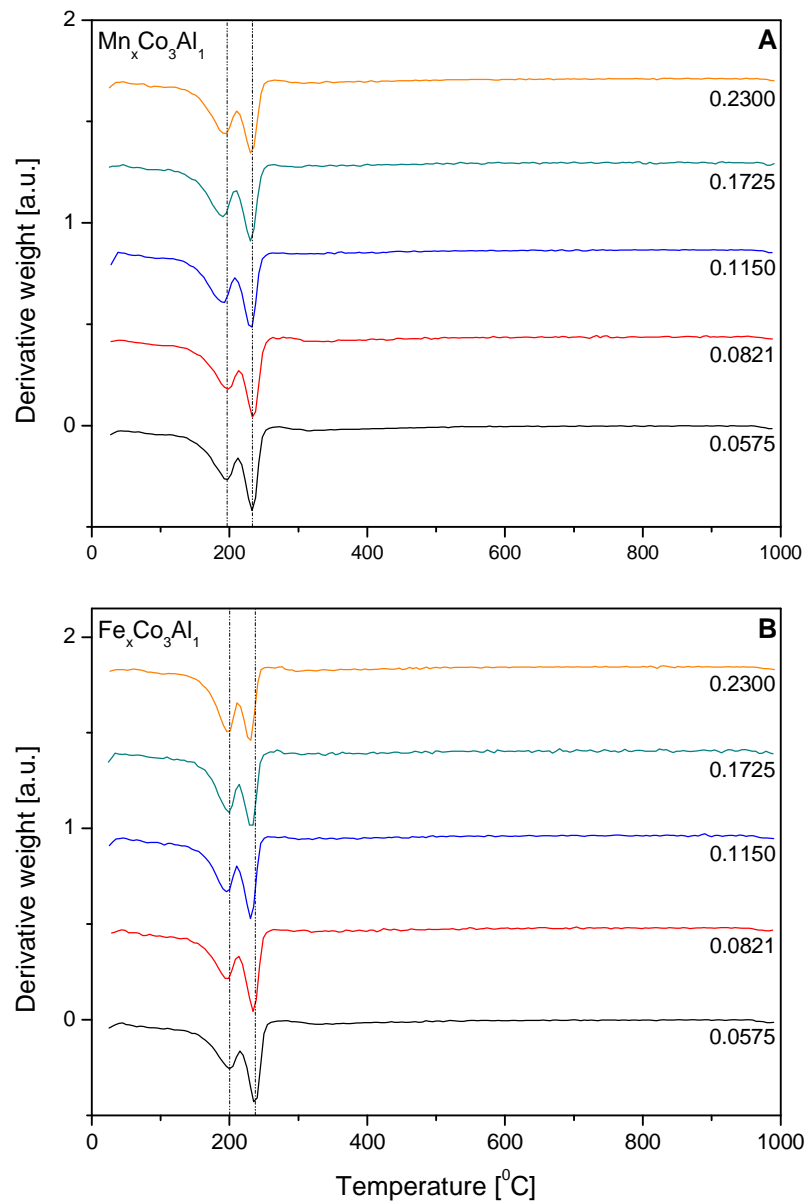


Fig. 2. DTG profiles of Mn(Fe)-Co-Al hydrotaalcite-like compounds; experimental conditions: mass of sample = 20 mg, flow of synthetic air = 10 cm<sup>3</sup>/min, liner heating rate of 5 K/min.

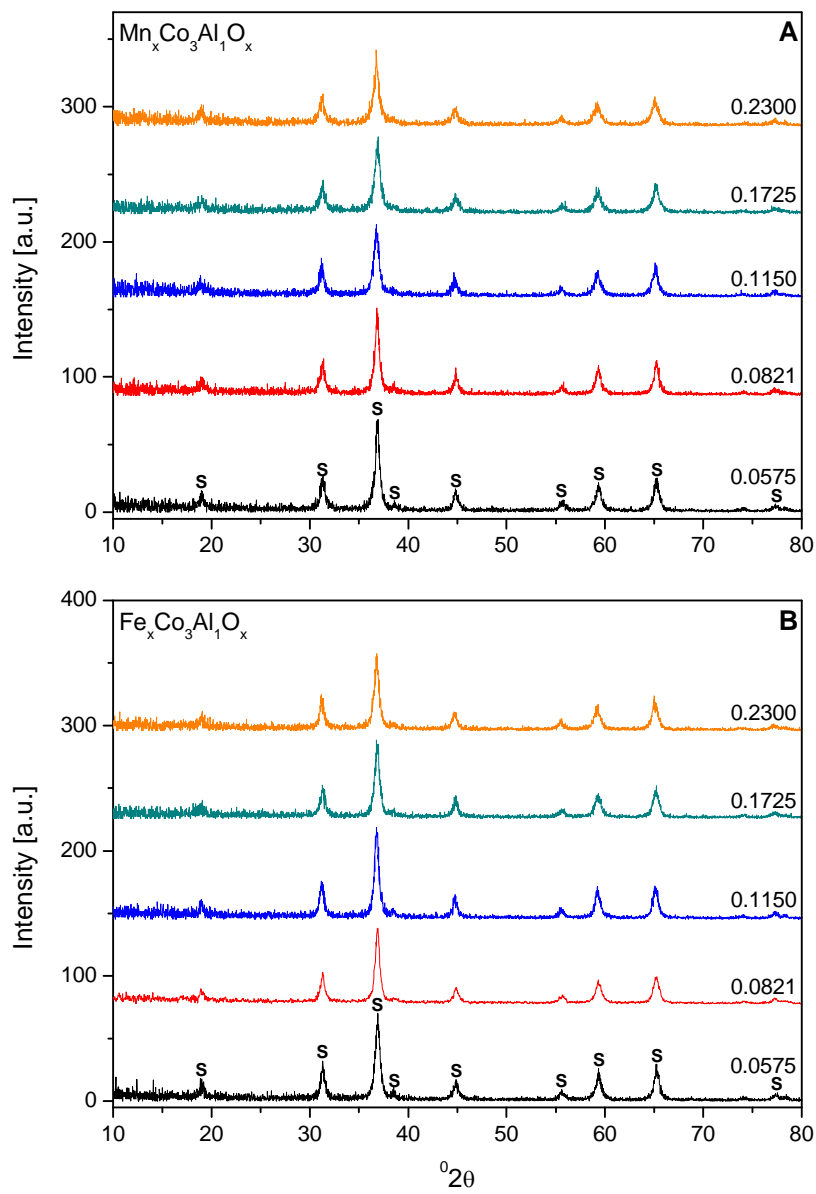


Fig. 3. X-ray diffraction patterns of Mn(Fe)-Co-Al mixed metal oxides; S –  $Co_3O_4/CoAl_2O_4/Co_2AlO_4$ .

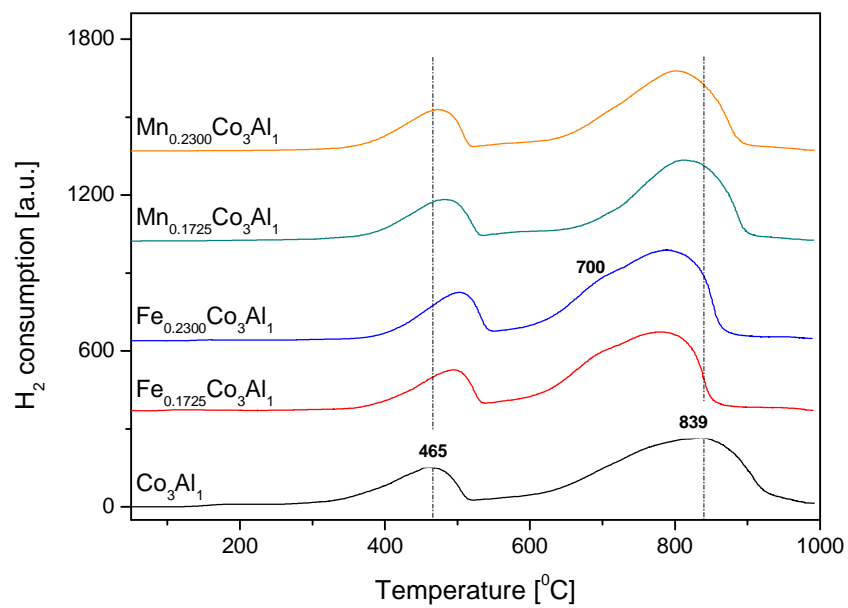
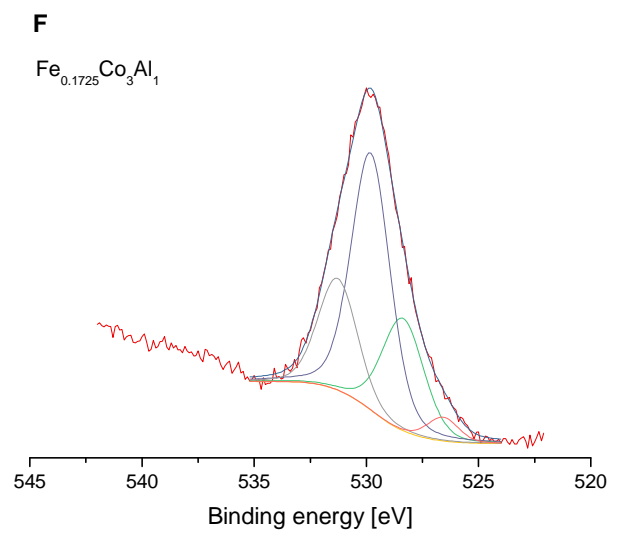
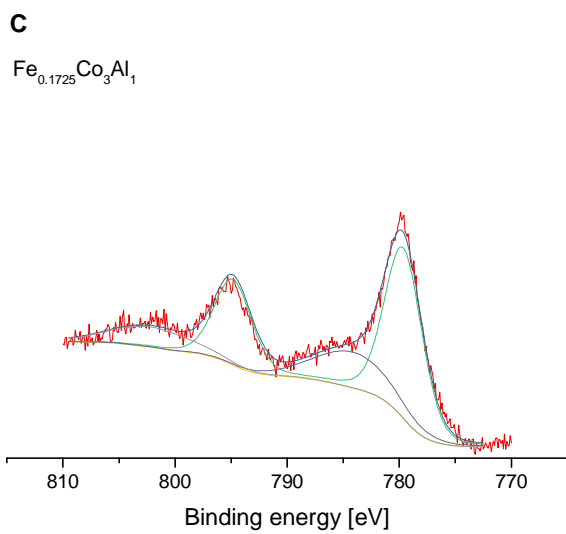
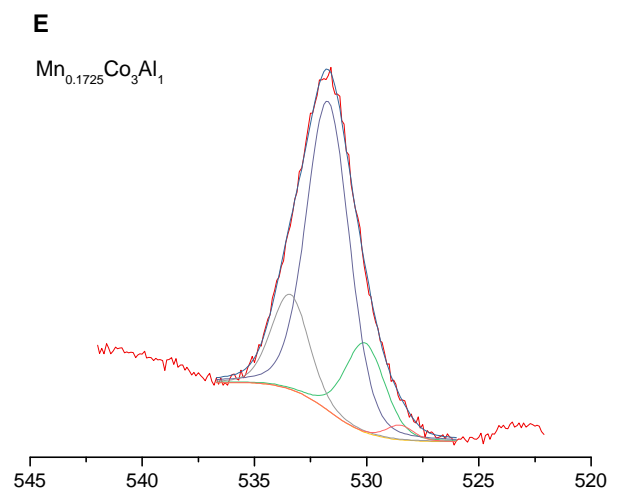
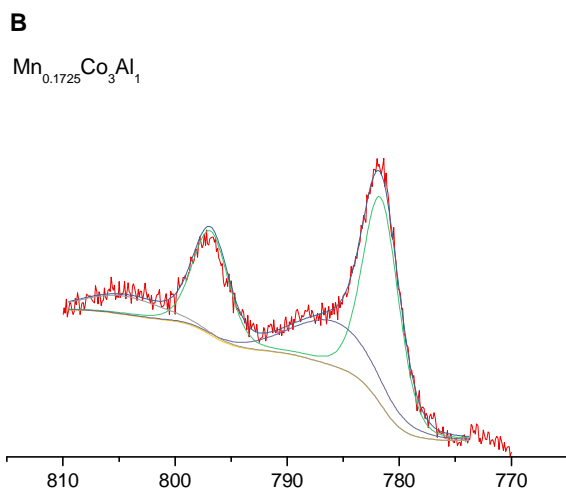
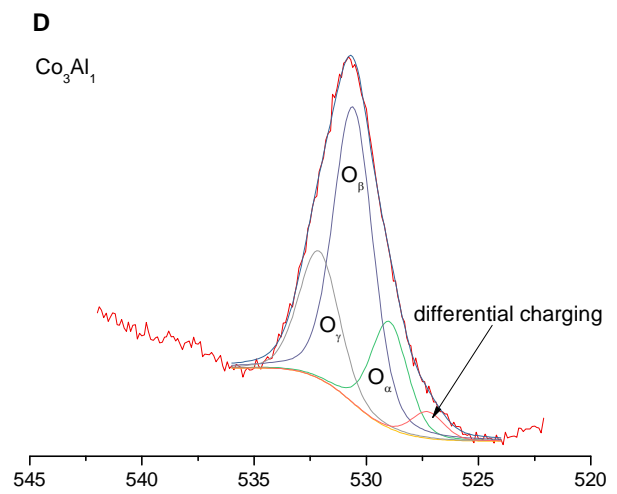
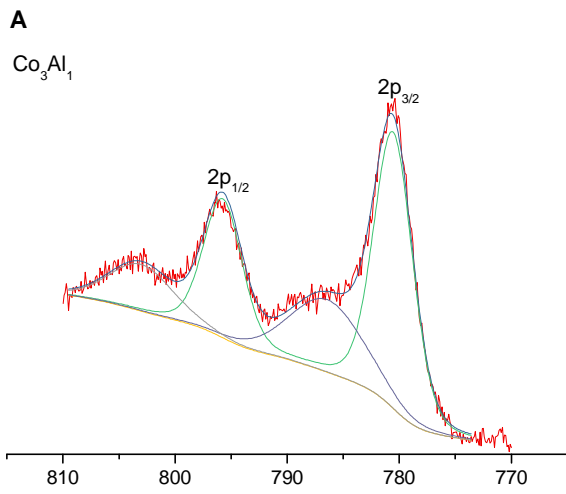


Fig. 4. H<sub>2</sub>-TPR profiles of selected (Mn,Fe)-Co-Al mixed metal oxides; experimental conditions: mass of catalysts = 30 mg, [H<sub>2</sub>] = 5.0 vol.%, [Ar] = 95.0 vol.%, flow rate = 25 cm<sup>3</sup>/min, linear heating of 5 K/min.



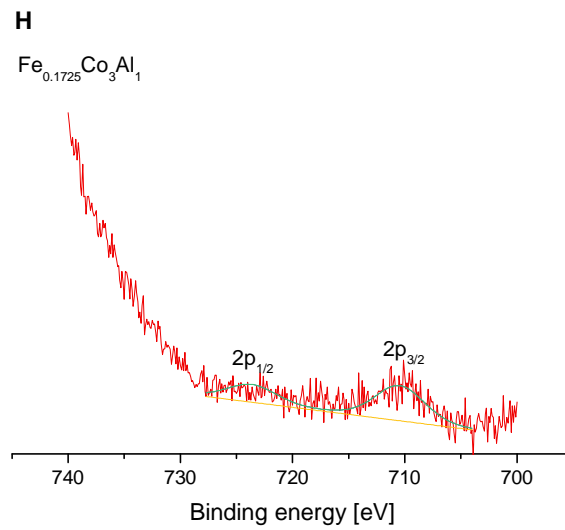
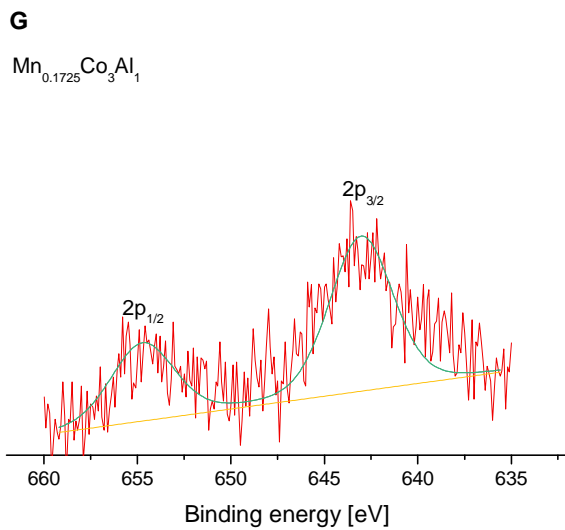


Fig. 5. XPS spectra of selected (Mn,Fe)-Co-Al mixed metal oxides; Co 2p (A-C), O 1s (D-F), Mn 2p (G) and Fe 2p (H).

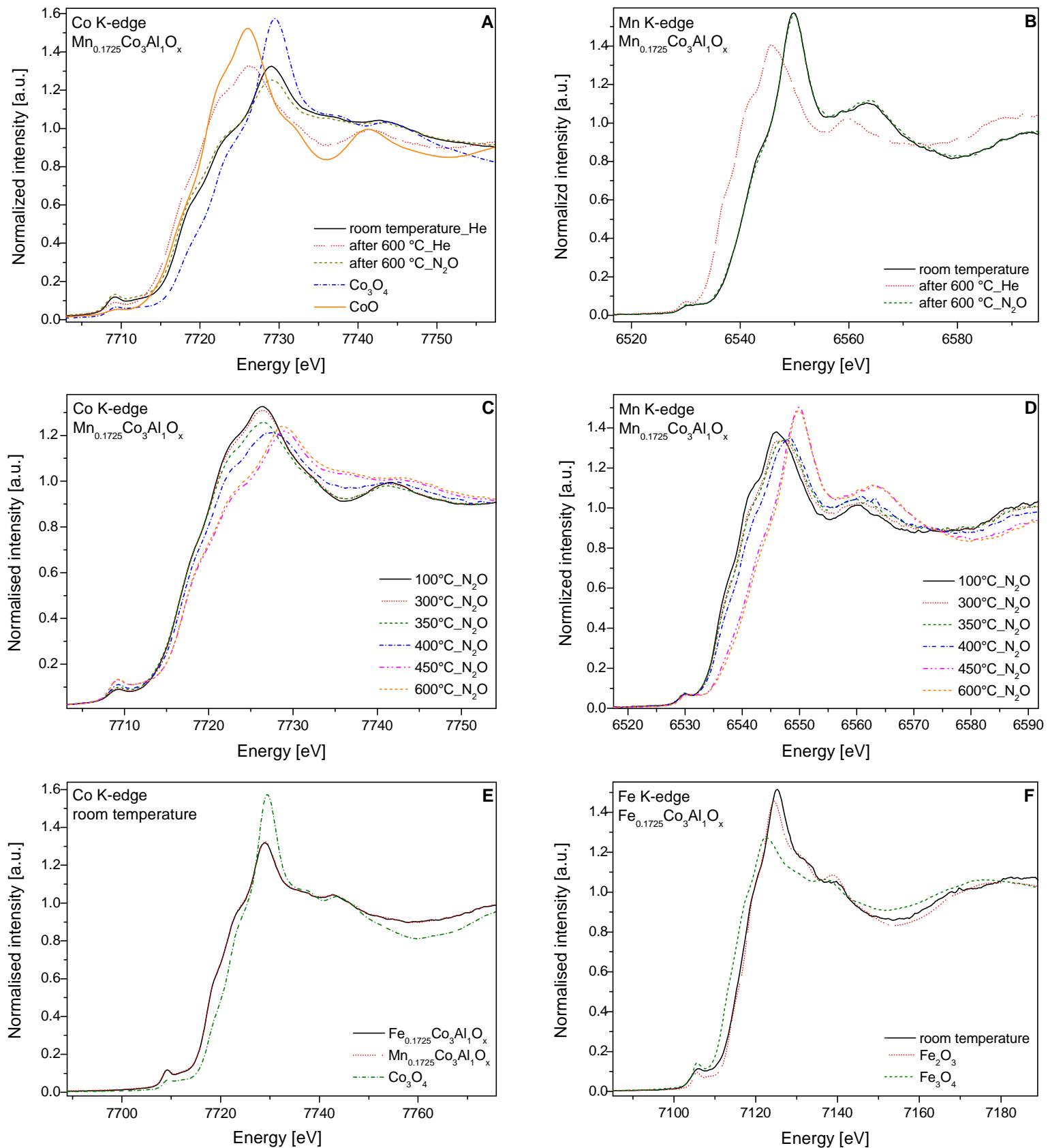


Fig. 6. *In situ* XANES spectra of A) Co K-edge for  $\text{Mn}_{0.1725}\text{Co}_3\text{Al}_1\text{O}_x$  at different reaction stages and Co references; B) Mn K-edge for  $\text{Mn}_{0.1725}\text{Co}_3\text{Al}_1\text{O}_x$  sample acquired at different stages of reaction; C) Co K-edge

during the temperature ramp under N<sub>2</sub>O; D) Mn K-edge during the temperature ram under N<sub>2</sub>O; E) Co K-edge for Mn<sub>0.1725</sub>Co<sub>3</sub>Al<sub>1</sub>O<sub>x</sub>, Fe<sub>0.1725</sub>Co<sub>3</sub>Al<sub>1</sub>O<sub>x</sub> and Co<sub>3</sub>O<sub>4</sub> reference at room temperature; and F) Fe K-edge for Fe<sub>0.1725</sub>Co<sub>3</sub>Al<sub>1</sub>O<sub>x</sub> and references.



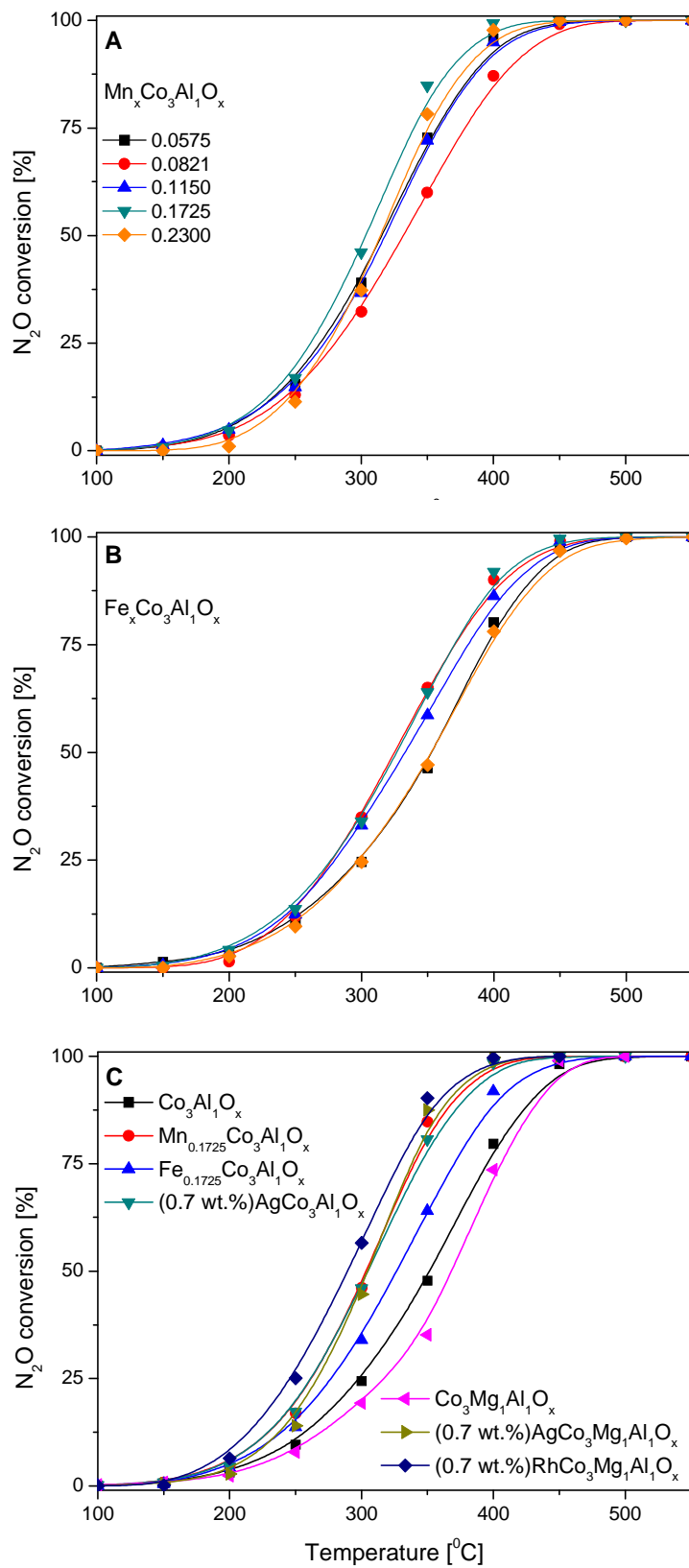


Fig. 7. Results of catalytic tests performed over  $\text{Co}_3\text{Al}_1\text{O}_x$ ,  $(\text{Mn,Fe})_x\text{Co}_3\text{Al}_1\text{O}_x$  ( $x = 0, 0.0575, 0.0821, 0.1150, 0.1725, 0.2300$ ) and  $(0.7 \text{ wt.}\%)\text{Ag}(\text{Rh})\text{Co}_3(\text{Mg}_1)\text{Al}_1$  mixed metal oxides; reaction conditions: mass of catalysts = 350 mg,  $[\text{N}_2\text{O}] = 0.1 \text{ vol.}\%$ ,  $\text{N}_2$  balance, total flow rate =  $100 \text{ cm}^3/\text{min}$ , WHSV of  $17 \text{ L} (\text{h g})^{-1}$ .