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## Supporting information:

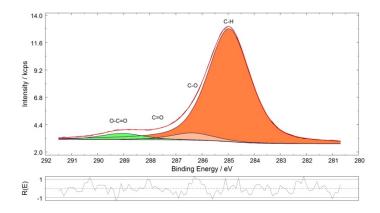


Fig. A: Highly resolved C 1s XP spectrum (non-monochromatized Al Kapha radiation) of sol-gel prepared FeF<sub>3</sub>.

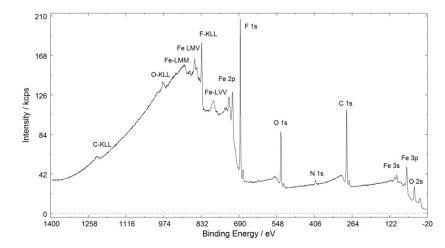


Fig. B: Survey XP spectrum (non-monochromatized Al Kapha radiation) of sol-gel prepared FeF<sub>3</sub>.

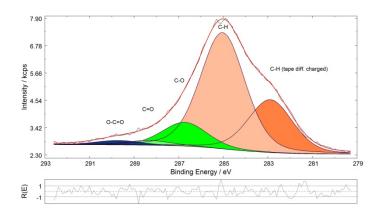


Fig. C: Highly resolved C 1s XP spectrum (non-monochromatized Al Kapha radiation) of the ternary  $FeF_3$ -MgF $_2$  catalyst.

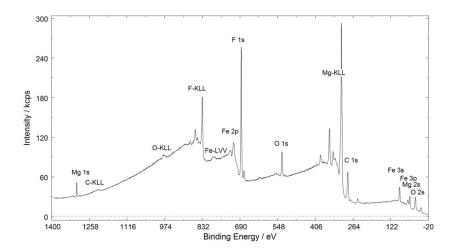


Fig. D: Survey XP spectrum (non-monochromatized Al Kapha radiation) of the ternary FeF<sub>3</sub>-MgF<sub>2</sub> catalyst.