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Phase Transformation of Ferrites by Gas-Solid Combustion Synthesis

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The mechanism of formation of hard magnetic hexaferrites: $BaFe_{12}O_{19}$, $SrFe_{12}O_{19}$, $PbFe_{12}O_{19}$, and cobalt monoferrite $CoFe_2O_4$, and soft magnetic ferrites: $Ni_{0.35}Zn_{0.65}Fe_2O_4$, $Mn_{0.73}Zn_{0.27}Fe_2O_4$, during gas-solid combustion synthesis was investigated. A combination of several investigation techniques, including quenching of the combustion front, X-ray diffraction, and thermal and magnetic analyses, was used to determine the sequence of phase transformations during synthesis. The combustion synthesis of different ferrites is a multistage process and involves several intermediate products, such as FeO, Fe_3O_4, $ZnFe_2O_4$, $BaFe_2O_4$ or $Sr_7Fe_{10}O_{22}$, and $PbFe_4O_7$. The formation of target final composition usually starts in postcombustion zones, and their conversion degree and properties strongly depend on the cooling rate.