Nickel-zinc spinel ferrites: Synthesis and magnetic characterization

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Nickel-zinc spinel ferrite ceramics are intriguing for safe remote heating applications. The reason is that on the one hand, substituting nickel with zinc allows tuning Curie temperature down to room temperatures; on the other hand, nickel-zinc ferrites have increased specific loss power, which is also referred to as specific absorption rate that represents the power dissipation per unit mass, due to magnetization increase in a significant region of substitutions over nickel ferrite. Essentially, it means that after putting such ceramics into media and turning on high frequency oscillating magnetic field (e.g. 100 kHz) these ceramics heat up to its Curie temperature, but not higher. This way even using thermometer is not strictly necessary.

Our current investigation is concerned with two methods of producing nickel-zinc ferrite nanoparticles: solid-phase synthesis and co-precipitation synthesis. Such investigation is necessary since properties of nanoparticles may significantly depend on the method of synthesis, and that directly affects properties of respective ceramics.

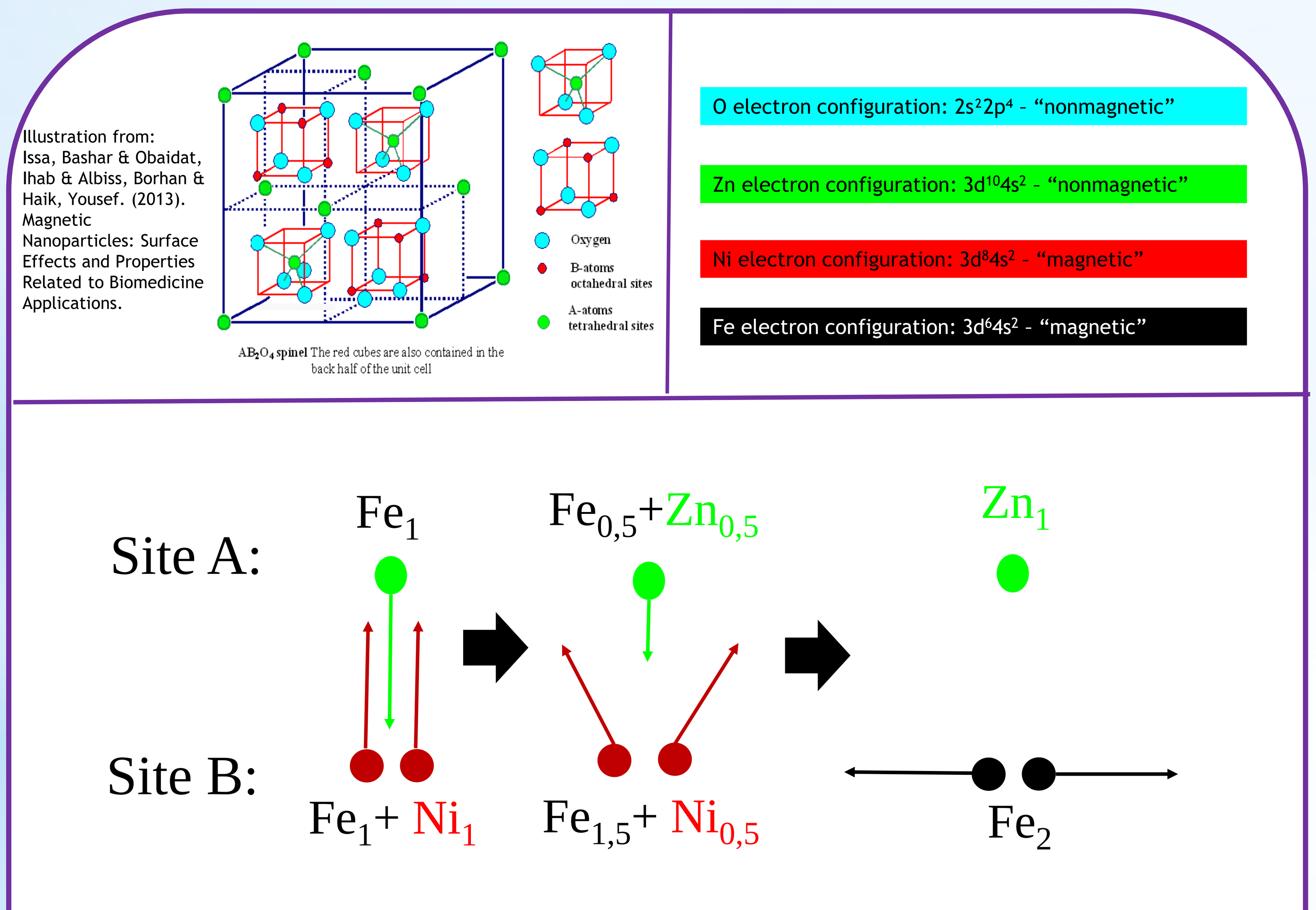

Fig. 1. Schematic illustration of magnetic moments change in nickel-zinc spinel ferrite with chemical substitution.

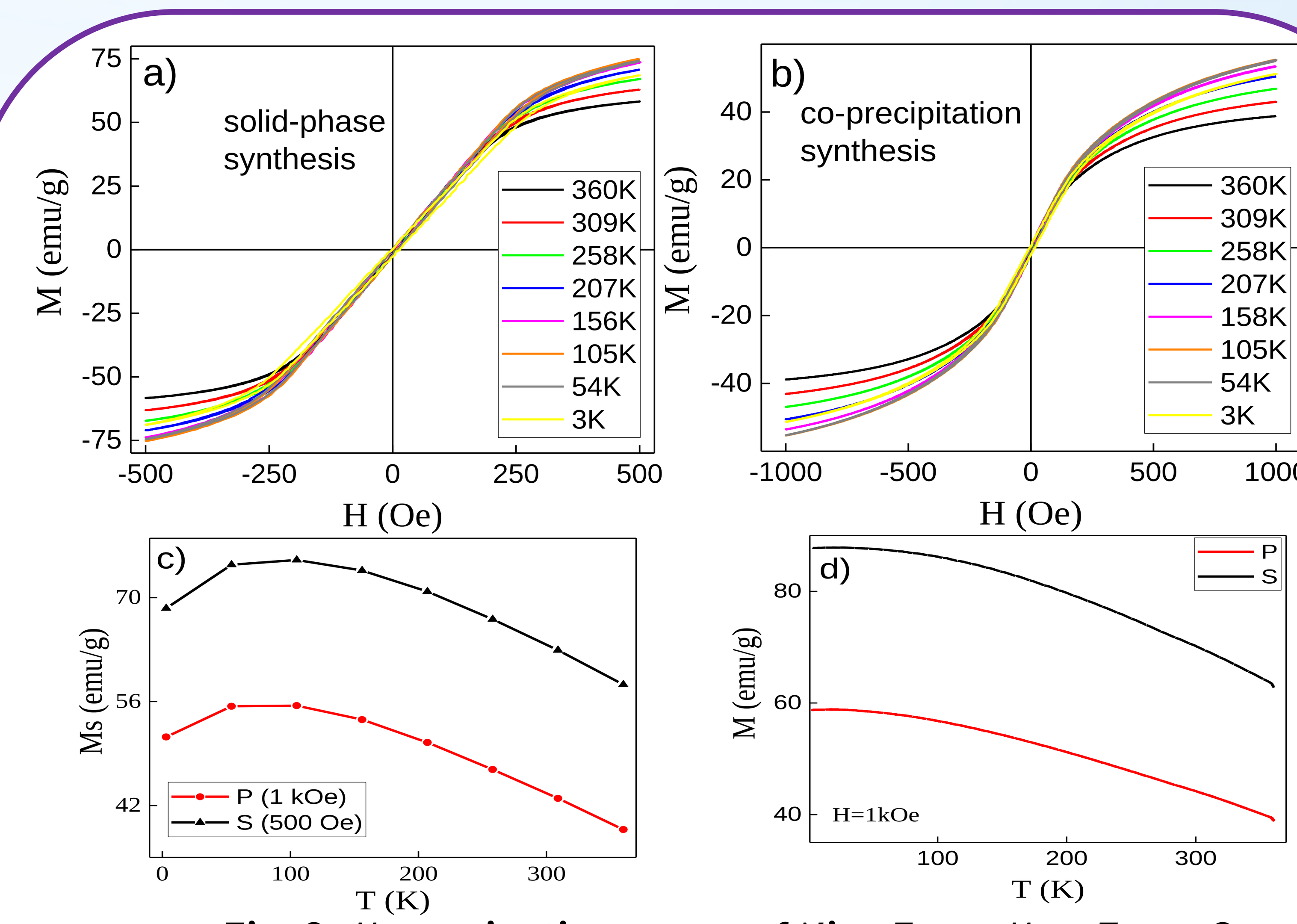

Fig. 2. Magnetization curves of $Ni_{0.69}Zn_{0.325}Mn_{0.1}Fe_{1.885}O_4$ ceramics: a) and b) are M(H) curves of samples obtained via solid-phase synthesis(S) and co-precipitation synthesis(P) respectively; c) saturation magnetization for both samples; d) ZFC curve in H=1kOe for both samples.

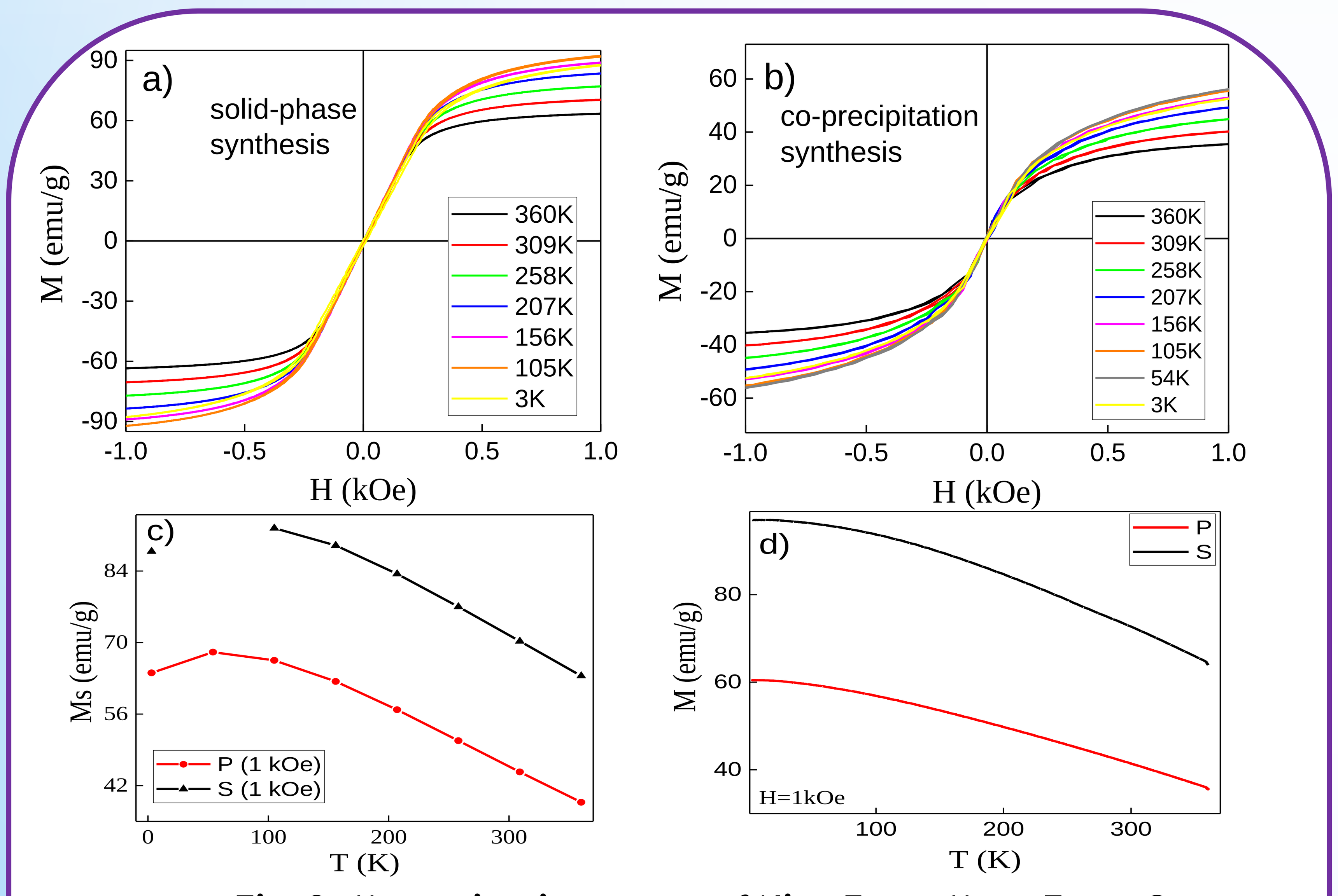

Fig. 3. Magnetization curves of $Ni_{0.65}Zn_{0.415}Mn_{0.05}Fe_{1.885}O_4$ ceramics: a) and b) are M(H) curves of samples obtained via solid-phase synthesis(S) and co-precipitation synthesis(P) respectively; c) saturation magnetization for both samples; d) ZFC curve in H=1kOe for both samples.

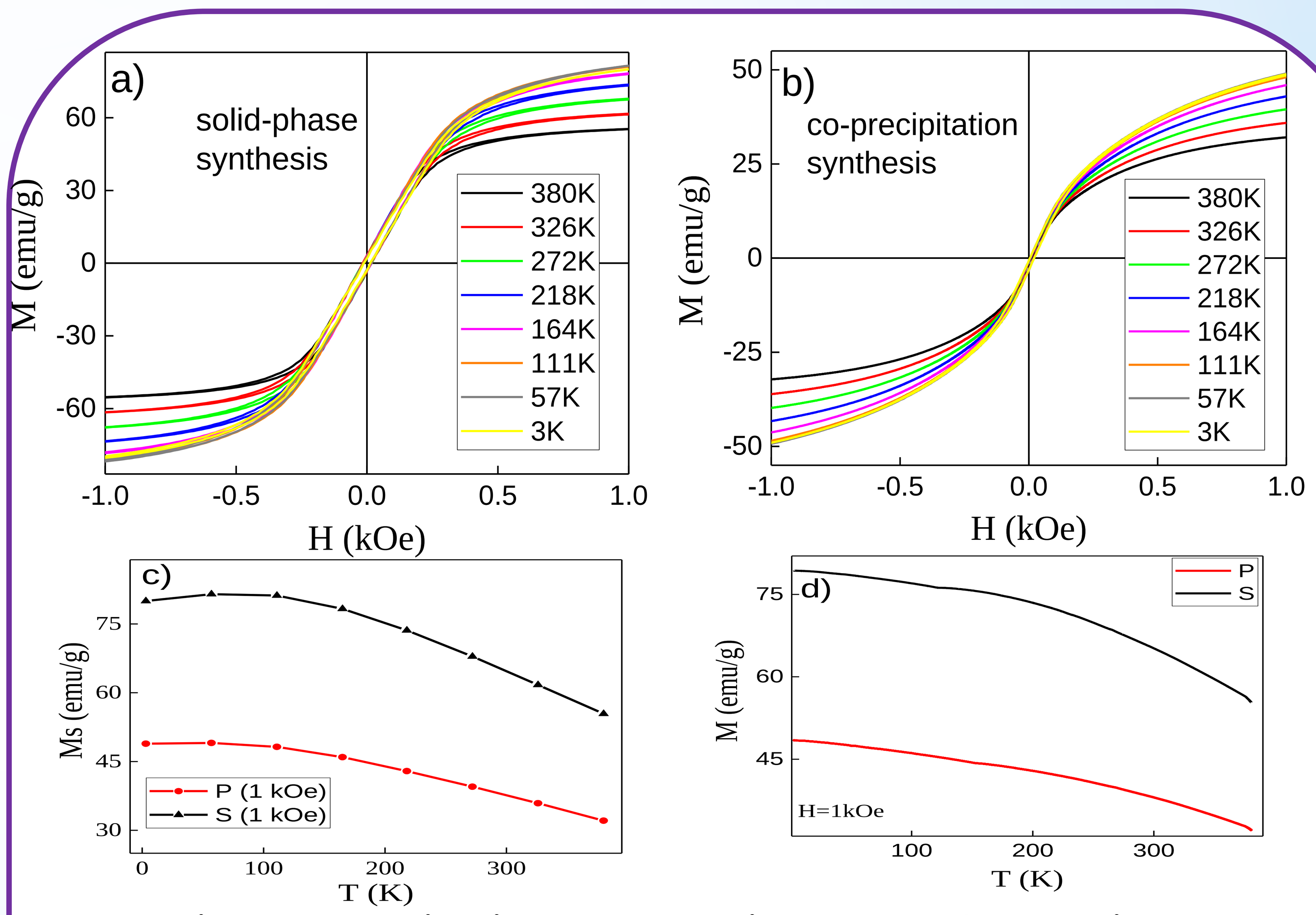

Fig. 4. Magnetization curves of $Ni_{0.7}Zn_{0.5}Fe_{1.8}O_4$ ceramics: a) and b) are M(H) curves of samples obtained via solid-phase synthesis(S) and co-precipitation synthesis(P) respectively; c) saturation magnetization for both samples; d) ZFC curve in H=1kOe for both samples.