Magnesium oxide can be used in a wide range of applications covering, for instance, a catalyst in organic chemistry, an adsorbent for a variety of toxic substances, and as a refractory material. There are many routes for preparation of MgO particles but the smallest crystallite size is usually obtained via sol-gel techniques. Here, we present an innovative method for production of magnesium oxide nanoparticles and their microstructure characterization by scanning and transmission electron microscopy (SEM and TEM). MgO can be prepared via a reaction between magnesium (Mg) and methanol (CH₃OH) that can be described as

\[
\text{Mg} + 2\text{CH}_3\text{OH} \rightarrow \text{Mg(OCH}_3\text{)}_2 + \text{H}_2 \tag{1}
\]

where the final products are magnesium methoxide Mg(OCH₃)₂ and hydrogen H₂. This reaction, however, practically does not occur at ambient temperatures and must be accelerated either by catalyst or by heating at higher pressures in reflux apparatus. The most common catalyst used is iodine. Although iodine is essential for nutrition, due to its toxicity in elemental form, higher price and problematic manipulation, this element introduces an obstacle for use. Very recently, it was shown that the reaction (1) can be significantly accelerated by Zn in solid solution of Mg. Final product Mg(OCH₃)₂ is a valuable precursor for production of nanocrystalline MgO (particle size ~5 nm) by simple thermal decomposition (400°C/2h), see Fig. 1.

Beside SEM and TEM, we employed a set of additional experimental techniques such as, mass spectroscopy combined with thermogravimetry, differential scanning calorimetry (DSC) and BET surface area analysis for thorough characterization of MgO nanoparticles prepared by thermal decomposition of Mg(OCH₃)₂.

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Fig. 1: SEM image of MgO powder (left) and high resolution TEM image of MgO particles (right).