Efek rasio diameter transduser dan reaktor pada proses pembentukan nanopartikel Ba0.7Sr0.3TiO3 dan Ba0.3Sr0.7TiO3 melalui destruksi ultrasonik = The effect of transducer and reactor diameter ratio in the formation of Ba0.7Sr0.3TiO3 and Ba0.3Sr0.7TiO3 nanoparticles by ultrasonic destruction / Agam Aidil Fahmi

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Abstrak

ABSTRAK
Karya tulis ini melaporkan hasil proses pembentukan nanopartikel Ba0.7Sr0.3TiO3 dan Ba0.3Sr0.7TiO3 melalui pemaduan mekanik dan destruksi ultrasonik daya tinggi. Proses destruksi ultrasonik dilaksanakan dalam 3 kondisi berbeda yaitu menggunakan variasi rasio diameter transduser dan reaktor 1:1.4, 1:1.6, dan 1:1.8 terhadap media mengandung partikel kosentrasi 3.0 gr/l selama waktu destruksi 3 jam. Secara spesifik, tujuan dari penelitian ini adalah mempelajari efek rasio diameter transduser dan diameter reaktor (dt/Dr) terhadap pembentukan nanopartikel Ba0.7Sr0.3TiO3 dan Ba0.3Sr0.7TiO3. Karakterisasi partikel yang diperoleh menggunakan XRD, PSA, dan SEM. Hasil identifikasi fasa material dari evaluasi difraksi sinar X memastikan bahwa material Ba0.7Sr0.3TiO3 dan Ba0.3Sr0.7TiO3 adalah material berfasa tunggal dan destruksi ultrasonik tidak menyebabkan perubahan fasa material. Kedua material berbeda dalam ukuran rata-rata partikel sebelum destruksi ultrasonik yaitu 538 nm untuk partikel Ba0.7Sr0.3TiO3 dan 480 nm untuk partikel Ba0.3Sr0.7TiO3. Kedua nilai ukuran rata-rata partikel ini mengalami penurunan selama proses destruksi ultrasonik. Namun, ukuran partikel terkecil masing-masing material adalah 38 nm dan 24 nm diperoleh pasca destruksi dengan (dt/Dr) adalah 1.8. Ukuran rata-rata partikel ini hampir sama dengan ukuran rata kristalitnya masing-masing 22 nm dan 14 nm. Dengan demikian hanya terdapat 1 kristalit dalam masing-masing partikel. Dapat disimpulkan bahwa nanopartikel baik material Ba0.7Sr0.3TiO3 maupun Ba0.3Sr0.7TiO3 dapat dihasilkan dari dua tahapan proses yaitu tahapan sintesis dengan pemaduan mekanik dan tahapan destruksi dengan metode destruksi ultrasonik daya tinggi. Partikel monokristalit Ba0.7Sr0.3TiO3 dengan ukuran 38 nm dan Ba0.3Sr0.7TiO3 dengan ukuran 24 nm telah dihasilkan dari destruksi ultrasonik menggunakan parameter proses (dt/Dr) 1.8 dalam durasi destruksi selama 3 jam.
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ABSTRACT
We report results of research on the formation of Ba0.7Sr0.3TiO3 and Ba0.3Sr0.7TiO3 nanoparticles through the mechanical alloying process and followed by high power ultrasonic destruction. Ultrasonic destruction process carried out in three different modes of the transducer and reactor diameter ratios respectively 1:1.4, 1:1.6, and 1:1.8 against the media containing particles of 3.0 g/l concentration during 3 hours destruction time. The specific goal of this work was to study the effect of transducer and reactor diameter ratio (dt/Dr) on the formation of Ba0.7Sr0.3TiO3 and Ba0.3Sr0.7TiO3 nanoparticles. Particle characterizations were carried out under the employment of XRD, PSA, and SEM. Results of material phase identification by XRD ensure that the synthesized Ba0.7Sr0.3TiO3 and Ba0.3Sr0.7TiO3 material are both single phase. In addition, the ultrasonic destruction to the particle materials did not cause the phase change. Prior to ultrasonic destruction, the two materials are different in their average particle size in which

Ba0.7Sr0.3TiO3 and Ba0.3Sr0.7TiO3 respectively has particles with mean sizes 538 nm and 480 nm. The average value for both particles was decreased during ultrasonic destruction. However, the smallest mean particle size of each material was 38 nm and 24 nm which were obtained after the ultrasonic destruction by (dt/Dr) of 1.8. These average sizes are almost equal to the average size of their crystallites which are respectively 22 nm and 14 nm. Thus there is only one crystallite within each particle. It can be concluded that both Ba0.7Sr0.3TiO3 and Ba0.3Sr0.7TiO3 nanoparticles can be produced by a two-stage process. The first stage is a phase formation by mechanical alloying and the formation of Ba0.7Sr0.3TiO3 and Ba0.3Sr0.7TiO3 nanoparticle obtained in the second stage in which the particle sizes were further reduced by the high power ultrasonic destruction. Single crystallite particles with a mean size of 38 nm for Ba0.7Sr0.3TiO3 and that of 24 nm for Ba0.3Sr0.7TiO3 have been successively obtained by ultrasonic destruction process with a parameter (dt/Dr) of 1.8 within 3 hours destruction time.