The natural material that can be used as the primary material for making MgO nanoparticles is Bangkalan dolomite. In its application, MgO needs to be combined with Carbon Nanofibers (CNFs) to become MgO@CNFs. CNFs are materials that have good physicochemical and mechanical properties, so it is exciting to be a supporting material. These nanocomposite biosensors can be utilized in several applications, such as supercapacitors and biosensors. The method in this study was grinding, sifting dolomite limestone and weighing 100 grams of dolomite, calcination at 300°C for 30 minutes, followed by 500°C for 30 minutes and 800°C for 1 hour, dissolve 50 grams of dolomite with 210 ml of HCL, then stirred at 75°C with a speed of 300 rpm until a white solution was formed, filtered the white solution, added NH₃ to pH 12, filtered the result then washed with distilled water until the pH was neutral and filtered again, oven the filter results at room temperature 90°C for 6 hours, calcify the product gradually at 300°C for 30 minutes, then at 500°C for 30 minutes and at 800°C for 8 hours. Mix 0.17 gram of MgO with 20 ml of distilled water, then ultrasonic for 70 minutes, after that add 2 grams of PVA and ultrasonify again for 75 minutes, electrospinning the sample with a voltage of 20 kV, calcination of the resulting nanofiber for 2 hours at 550°C to form carbon nanofibers. This study used X-ray diffraction (XRD) characterization to determine the structure of MgO@CNFs produced by electrospinning using the Bangkalan dolomite method.

**Keywords**: MgO, CNFs, Bangkalan Dolomite, Electrospinning

**INTRODUCTION**

The content of MgO has potential in the medical world, namely as an antibacterial and treatment medium. Several studies have used Mg²⁺ to synthesize Mg(OH)₂ and MgO nanoparticles. However, there are natural minerals such as dolomite and magnesite that can be used as a source of Mg²⁺ with the advantage of being cheaper and more suitable for industrial use than commercial materials. Natural materials that can be used as the main material for the manufacture of MgO nanoparticles are Bangkalan dolomite.

Based on data from the ESDM Office of East Java, Bangkalan Regency has limestone reserves of ±145,501,401,295.86 tons. Dolomite is a type of limestone that has two grams of carbonate. The decomposition process of calcium carbonate and magnesium carbonate in dolomite can be carried out by partial calcination.

Carbon Nanofiber is a material that has good physicochemical and mechanical properties, so it is very interesting to be a supporting material in biosensor applications. This is because various functional groups on the surface of CNFs can be used as selective immobilization and stability of hemoglobin biomolecules. In addition, CNFs also have excellent electrochemical response transduction and electrocatalytic abilities, so they are very supportive when used to detect electrochemical reactions. MgO@CNFs nanocomposite was used as a pretreatment to increase the
reproducibility of the electrode surface\(^6\). With this research, it aims to create and characterize the MgO@CNFs nanocomposite.

**MATERIALS AND METHOD**

**MATERIALS**

The materials used to fabricate magnesium oxide/carbon nanofibers are MgO, Poly Vinyl Alcohol (PVA) as polymer and distilled water as solvent. The equipment used in this experiment include beakers and measuring cups as a medium for pouring materials, digital scales as measuring materials used, ultrasonication to homogenize the solution and accelerate the reaction rate with the help of waves, stirrer, furnace and electrospinning device to produce nanofibers.

**PREPARATION FOR FABRICATION OF MgO@CNFs**

Grind the dolomite using a mortar pestle, sift and weigh 100 grams of dolomite sand, calcination at a temperature of 300°C for 30 minutes, followed by a temperature of 500°C for 30 minutes and a temperature of 800°C for 1 hour, dissolving 50 grams of dolomite with 210 ml of HCL, then stirrer at a temperature of 75°C with 300 rpm until a white solution is formed, filtering the white solution, adding NH\(_3\) to pH 12, filtering the results and then washing with distilled water until the pH is neutral and filtering again, oven the filter results at 90°C for 6 hours, calcining the product gradually at 300°C for 30 minutes, further at 500°C for 30 minutes and at 800°C for 8 hours, mixing 0.17 grams of MgO with 20 ml of distilled water and ultrasound for 70 minutes, adding 2 grams of PVA. Ultrasound again for 75 minutes, electrospinning the sample with a voltage of 20 kV, calcining the resulting nanofiber for 2 hours at 550°C to form carbon nanofibers.

**CHARACTERIZATION**

X-Ray Diffraction (XRD) characterization was done to determine how the primary phase formed in the sample. The samples powder in the form of powder were characterized using an XRD type Xpert MPD system using a Cu radiation source of 35 mA, 40 kV with a wavelength of 1.54 Å and an angle of 2 theta 10° - 80°. The phase that appears at each peak can be identified with QualX software. The Debye-Scherrer formula, which is written as the following equation, can be used to determine the crystalline size of MgO as:

\[
D = \frac{K\lambda}{\beta\cos\theta}
\]  

(1)

Where \(D\) is the particle size, \(K\) is the form factor of the crystal (0.9 - 1), \(\lambda\) is the X-ray wavelength (0.15 Å), is the value of Full Width at Half Maximum (FWHM), which is determined by looking at the value the widening of the half-curves of the diffraction peaks in each crystal plane at positions 2θ and is the diffraction angle (degrees).

**RESULT AND DISCUSSION**

The results of XRD analysis in this study can identify the crystal structure, crystal size and phase of the MgO sample and determine the basis of the MgO@CNF sample. The XRD 1 pattern shows that each phase of MgO is formed at an angle of 2θ, namely 36.96°, 42.93°, 62.30°, 74.66° and 78.60°. then MgO@CNFs are formed at an angle of 2θ, namely 27.19°, 29.76°, 35.26°, 40.86°, 42.83° and 62.08°. Figure 1(a) shows that the synthesized MgO nanoparticles were of high purity because no other characteristic impurity peaks were observed. The crystal size of MgO is calculated using the Debye-Scherrer formula in equation 1. The results of the analysis show that the maximum diffraction peak of MgO lies at an angle (2θ) 42.93° with an average crystal size of 60.5 nm. In Jannah & Rohmawati\(^7\) research, the crystal size of CaCO\(_3\) was 21.07 nm and MgO powder had a crystal size of around 47.72 nm from the synthesis of nanocrystalline CaCO\(_3\)/MgO using the mixing method. Saputri & Rohmawati\(^2\) produced a crystal size of 20.12 nm by leaching MgO synthesis method. Crystals are defined as materials with a size range of 1 – 100 nm\(^3\). Thus the MgO samples synthesized from dolomite are nano-sized.
Based on Figure 1(b) shows that MgO@CNFs have semi-crystalline properties due to the presence of carbon in the result of calcining nanofibers, so it is not a crystalline material. Then the results of the analysis show that the maximum diffraction peak of MgO is located at an angle (2θ) 42.8303° and is supported by two small peaks at an angle (2θ) 40.8657° and 62.0846°, following the results of research by Alvionita & Astuti\textsuperscript{9}, namely the maximum diffraction peak of MgO at an angle of 42.859°. Research Fatiqin et al.\textsuperscript{10} produced a maximum MgO diffraction peak at an angle of 42.915° and in the study of Saputri & Rohmawati\textsuperscript{2} it produced a maximum diffraction peak of MgO at an angle of 42.96°. Then at angles (2θ) 27.1949°, 29.7699°, and 35.2608° are the maximum diffraction peaks of Carbon Nanofibers (CNFs), follow the results of Melati & Hidayati\textsuperscript{11} research, namely the maximum diffraction peak of CNFs at an angle of 25, 50°. Zhou \textit{et al.}\textsuperscript{12} with a maximum CNFs diffraction peak at an angle of 25° and Din \textit{et al.}\textsuperscript{13} showed the maximum CNFs diffraction peak at an angle of 26°. Confirmation of the results obtained with levers using standard JCPDS XRD data number 96-900-6458.
<table>
<thead>
<tr>
<th>2θ</th>
<th>FWHM</th>
<th>Crystallite size (nm)</th>
<th>Average size of crystallite size</th>
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<tr>
<td>36.9647</td>
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<th>2θ</th>
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<tr>
<td>62.0846</td>
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The above table is the crystal size of the synthesized MgO nanoparticles and MgO@CNFs. Table 1 shows the crystal size of MgO nanoparticles synthesized from Bangkalan Dolomite which has high purity with the maximum diffraction peak of MgO located at an angle of (20) 42.93° and an average crystal size of 60.5 nm. Table 2 shows the size of MgO crystals. @CNFs has a maximum diffraction peak of MgO at (20) 42.8303°.

CONCLUSION

The fabrication of MgO@CNFs from Bangkalan dolomite and Poly Vinyl Alcohol (PVA) was successfully carried out using the electrospinning method, then the results from the electrospinning were calcined at 550°C for 2 hours. XRD characterization results show that the main phase of MgO@CNFs is semi-crystalline due to the presence of carbon from the calcined nanofibers. Then the MgO main phase showed that the synthesized MgO nanoparticles had high purity because no other characteristic impurity peaks were observed. The synthesized MgO nanoparticles produced an average MgO crystal size of 60.5 nm.

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