Zinc doped copper oxide nanoparticles were synthesized by chemical precipitation method. Copper acetate is act as a precursor and sodium hydroxide will act as a reducing agent. The prepared nanoparticles were characterized by X-ray diffraction (XRD) which reveals the simple monoclinic structure. The Fourier Transform Infrared Spectroscopy confirms the functional groups present in the nano powders. The morphological Structure of the prepared crystals are analyzed by Scanning Electron Microscopy (SEM) were showed that the products consists of flaky in nature. The Bandwidth of the synthesized sample was calculated by UV-visible spectrum. The presence of compounds in nano powders were confirmed by Energy Dispersive X-ray diffraction (EDAX). Copper oxide has applications as a P-type semiconductor, because it has a narrow band gap of energy of 1.2 eV. Zinc doped copper oxide has applications in the wide variety of fields such as medicine, industries, sunscreens, agriculture etc.

Keywords: XRD, SEM, FTIR, UV, EDAX.
drop by drop and it was stirred at 60°C at 650 rpm for one and half hours until a black precipitate was obtained. The obtained solution was kept at rest for one day. The removal of impurities was done by washing the obtained precipitate with ethanol and distilled water for several times. Then washed precipitate was dried in hot oven at 100°C for 24 hrs. The final product was annealed in muffled furnace at 400°C for 2 hrs. Finally, the Zn doped copper oxide nano particles were synthesized.

3. Results and Discussions

3.1 XRD Analysis

The crystallography analysis of the nano powders was investigated by XRD diffraction method. The XRD pattern of Zn doped CuO is shown in Fig. Then the sharp peaks showed that the synthesized powders were nano crystalline nature. The crystallite size of the Zn doped CuO were calculated using Debye Scherrer formula

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

Where,
\[ D = \text{crystallite size in nanometers}, \]
\[ \lambda = \text{Wavelength of the radiation}, \]
\[ k = \text{constant equal to 0.94}, \]
\[ \beta = \text{full width half maximum of the peak in radiance} \] (FWHM)
\[ \theta = \text{Diffracted angle of X-ray pattern} \]

The calculated average crystalline size of the Zn doped CuO from XRD pattern and various parameters.

3.2. Fourier Transform Infrared Spectroscopy analysis

The FTIR spectrum of zinc doped copper oxide nanoparticles synthesized by chemical precipitation method is shown in figure5.2 respectively. The wavelength region was recorded in the range 400-4000 cm\(^{-1}\). The absorption peak at 3037.89 cm\(^{-1}\) corresponds to the O-H alcohol stretching. The absorption peak at 2748.56 cm\(^{-1}\) corresponds to the C-H aldehydes stretching. The absorption peak at 989.48 cm\(^{-1}\) corresponds to the C=C alkanes bonding. The absorption peak at 1068 cm\(^{-1}\) corresponds to the S=O sulfoxide stretching.

<table>
<thead>
<tr>
<th>Sample Name</th>
<th>(2\theta) (deg)</th>
<th>Interplanar spacing</th>
<th>FWHM (deg)</th>
<th>Crystallite size (D)x10(^{-9})</th>
<th>Average crystallite size(D)x10(^{-9})</th>
<th>Dislocation Density 10(^{-3})</th>
<th>Micro strain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc doped copper oxide</td>
<td>35.6622</td>
<td>2.51558</td>
<td>0.75490</td>
<td>11.1136</td>
<td>12.2143</td>
<td>8.0963</td>
<td>3.257</td>
</tr>
<tr>
<td></td>
<td>38.9236</td>
<td>2.31198</td>
<td>0.83780</td>
<td>10.5092</td>
<td></td>
<td>9.0542</td>
<td>3.444</td>
</tr>
<tr>
<td></td>
<td>36.4000</td>
<td>2.46626</td>
<td>0.58180</td>
<td>15.020</td>
<td></td>
<td>4.4324</td>
<td>2.410</td>
</tr>
</tbody>
</table>
increases in wavelength. The calculated band gap energy for the samples is tabulated.

3.3 **Scanning Electron Microscopy (SEM) analysis**

The surface morphology of zinc doped copper oxide nano powder synthesized by chemical precipitation method is analyzed using scanning electron microscope. The SEM image of nano zinc doped copper oxide powder is shown in figure 1.4. The SEM image of images of zinc doped copper oxide particles show a nano flakes in nature.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Absorption</th>
<th>Band gap(eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc doped copper oxide</td>
<td>1056</td>
<td>1.17</td>
</tr>
</tbody>
</table>

### Table 3: UV-Vis data of Zn doped CuO nanoparticles

3.4 **EDAX Analysis**

The chemical composition of zinc doped copper oxide nanoparticles prepared at the optimized conditions was extracted from the energy dispersive X-ray spectrum (EDAX) which is shown in Figure 4. The EDAX analysis exhibited clear peaks of analysis exhibited clear peaks of only Zn, Cu and O elements, whereas no additional peaks were detected, which means that the as-prepared powder is exempted from impurities that arises from the starting precursors. The atomic percentage of Zn, Cu and O elements present in the as-present powder are 62.65, 32.74, 4.61% mass respectively. The results are shown in Table 4.

<table>
<thead>
<tr>
<th>El</th>
<th>Series</th>
<th>C norm. [wt]</th>
<th>C Atom. [at. %]</th>
<th>C Error (1 sigma) [wt%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn</td>
<td>k-series</td>
<td>29.62</td>
<td>62.65</td>
<td>0.80</td>
</tr>
<tr>
<td>O</td>
<td>k-series</td>
<td>61.47</td>
<td>32.74</td>
<td>0.94</td>
</tr>
<tr>
<td>Cu</td>
<td>k-series</td>
<td>8.90</td>
<td>4.61</td>
<td>0.83</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.00</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4: EDAX analysis of Zn doped CuO nanoparticles

![Fig. 2: UV-Vis Spectra of Zn doped CuO nanoparticles](image)

![Fig. 3: SEM image of Zn doped CuO nanoparticles](image)

![Fig. 4: Shows the EDAX analysis of Zn doped CuO nanoparticles](image)

### 4. Conclusion:

Copper oxide nanoparticles were successfully synthesized by chemical precipitation method. X-ray diffraction studies show that the particles are monoclinic in nature. The functional groups present in synthesized copper oxide nanoparticles have been confirmed by FTIR spectrum. SEM images shows that the formation of Zn doped CuO nano crystals were flaky in nature. The EDAX analysis exhibited clear peaks of only Zn, Cu, O elements, whereas no additional peaks were detected.

### References


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