Supplementary

A diagram of a molecule

Description automatically generated

Supplementary Figure 1. Structure of SPE based on FTIR Analysis

**Table 1** FWHM Calculation Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample | Peak 1 | | Peak 2 | | Peak 3 | | FWHM avg. (°) |
| 2θ  (°) | FWHM  (°) | 2θ  (°) | FWHM  (°) | 2θ  (°) | FWHM  (°) |  |
| CS | 15 | 0.834 | 17 | 0.262 | 17.5 | 0.756 | 0.618 |
| CSGY | 15 | 0.665 | 19.7 | 0.818 | 22.07 | 0.864 | 0.841 |
| CSLa | 16.9 | 1.074 | 19.3 | 1.139 | 22.2 | 1.224 | 1.146 |
| CSLa:GO 0.5% | 16.95 | 1.077 | 19.38 | 2.408 | 22.12 | 1.338 | 1.608 |
| CSLa:GO 1% | 16.83 | 1.075 | 19.21 | 2.388 | 21.88 | 1.404 | 1.622 |
| CSLa:GO 1.5% | 16.78 | 1.626 | 19.74 | 2.432 | 22.27 | 1.485 | 1.847 |
| CSLa:GO 2% | 17 | 1.656 | 19.84 | 2.648 | 22.18 | 1.856 | 2.053 |

Table 1 presents the full width at half maximum (FWHM) value of SPE. The decrease in intensity is an indication of an increasingly amorphous sample due to decreased crystallinity, allowing an increase in ionic conductivity in the sample (Azli et al., 2017). The reduction in intensity can be validated through the computation of FWHM. High FWHM values suggest a significant amorphous fraction present in the polymer (Norjeli et al., 2022).

**Table 2** FTIR functional group of SPE

|  |  |
| --- | --- |
| Wavenumber (cm-1) | Functional Group |
| 3300 – 3400 | O-H Stretching |
| 2927 | C-H Stretching |
| 1650 | O-H Bending |
| 1300 – 1500 | CH and CH2 deformation in CH2OH |
| 1151 | C-O stretching in C-O-H |
| 1077 | C-O stretching in C-O-H |
| 1020 | C-O-H deformation |
| 997 | C-O stretching in C-O-C |