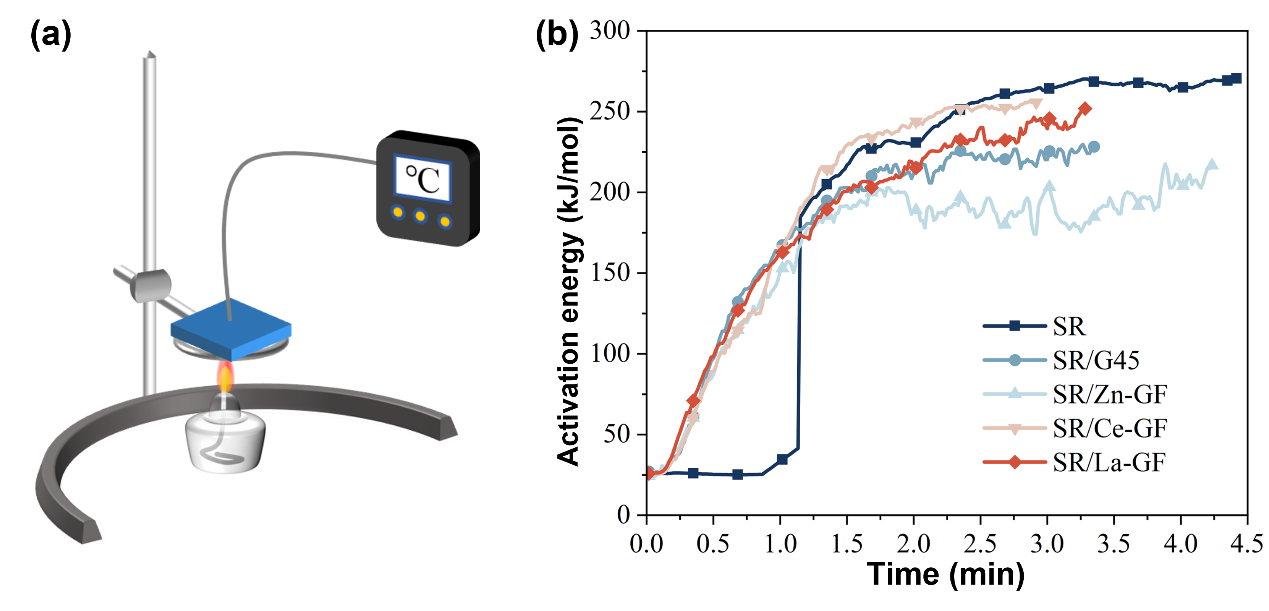
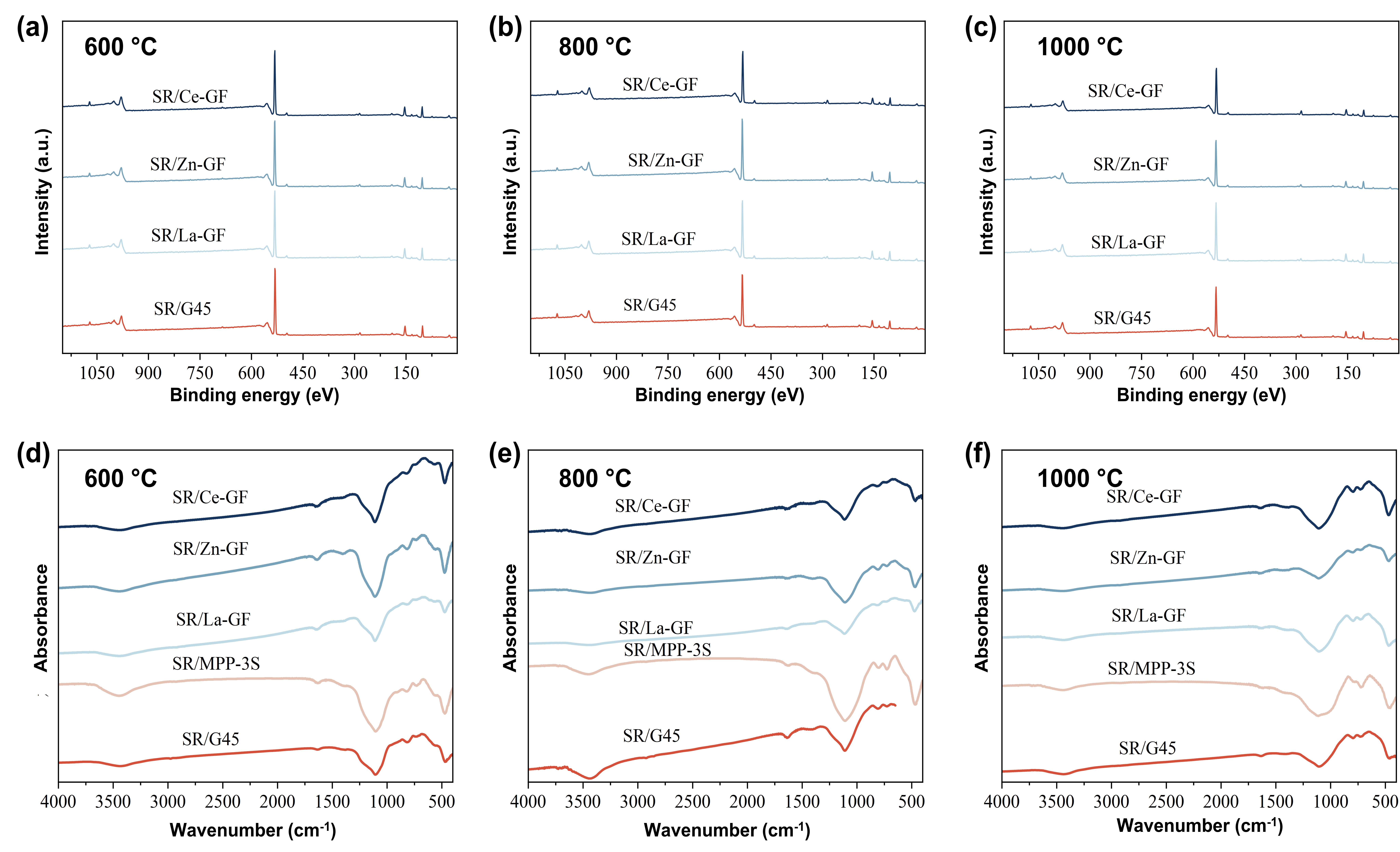
**S1 Fire exposure test**



**Figure S1** (a) Schematic diagram of the fire exposure test, (b) Time-temperature curve of the fire exposure test deviating from one end of the flame.

Figure S1 presents the schematic diagram of the back panel burn test and the corresponding time-temperature curve for a test with one end removed from the flame. The temperature rise curve indicates that the sample containing fillers exhibits a faster initial temperature rise rate. This observation may be attributed, to some extent, to the increased thermal conductivity resulting from the addition of fillers. This enhancement in conductivity likely facilitates a more rapid transfer of heat throughout the material, accelerating the initial temperature increase. As the temperature stabilizes, the samples containing different fillers exhibit varying temperatures, with SR/Ce-GF having the highest, followed by SR/La-GF, SR/G45, and SR/ZnB-GF in descending order. These results suggest that the incorporation of ceramic fillers and flame retardants significantly enhances the thermal protection ability of silicone rubber. Furthermore, the addition of modified glass powder appears to further improve the protective effect, demonstrating its efficacy in augmenting the material's resistance to heat. This indicates that the choice of filler plays a crucial role in determining the thermal behavior and protective capabilities of silicone rubber composites.

**S2 X-ray photoelectron spectroscopy analysis and infrared spectra analysis**



**Figure S2** (a-c) X-ray photoelectron spectroscopy of ceramic residues from samples calcined at different temperatures. (d-f) Infrared spectra of ceramic-like residues of samples calcined at different temperatures in air.

Figure S2a-c presents the X-ray photoelectron spectroscopy (XPS) analysis of the ceramic residues from SR/Ce-GF, SR/Zn-GF, SR/La-GF, and SR/G45 after calcination at temperatures of 600, 800, and 1000°C. The spectra for all samples show orbital peaks corresponding to Na 1s, O 1s, P 2p, Si 2p, and Al 2p at approximately 173, 532, 134, 103, and 74 eV, respectively. These results confirm the presence of these elements in the ceramic residues, providing evidence of their compositional stability across various calcination temperatures.

Figure S2d-f displays the infrared spectra of the ceramic residues from SR/Ce-GF, SR/Zn-GF, SR/La-GF, and SR/G45 after calcination at temperatures of 600, 800, and 1000°C. As noted earlier, the absorption peaks at 3455 and 1630 cm-1 are attributed to the stretching and bending vibration absorption peaks of adsorbed water O-H, respectively. The peaks at 1100 and 457 cm-1 are associated with the stretching and deformation vibration absorption peaks of Si-O-Si. Additionally, the peaks at 805 and 560 cm-1 are characteristic absorption peaks of [AlO6] complexes. Lastly, the peaks at 1412 and 718 cm-1 correspond to the stretching vibration absorption peaks of P=O and P-O, respectively, highlighting the structural integrity and compositional traits of the ceramic materials post-calcination.

**Table S1** XRF element semi-quantitative analysis.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **SiO2** | **Al2O3** | **ZnO** | **Na2O** | **K2O** | **CaO** | **BaO** |
| **59.8%** | **29.1%** | **3.4%** | **2.8%** | **1.6%** | **0.6%** | **0.6%** |

**Table S2** Activation Energy (Ea) and Correlation Coefficient (R) by DAEM.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **α** | **SR/G45** | | | **SR/Ce-GF** | | **SR/ZnB-GF** | | **SR/La-GF** | |
| **Eα(kJ/mol)** | **R** | **Eα(kJ/mol)** | | **R** | **Eα(kJ/mol)** | **R** | **Eα(kJ/mol)** | **R** |
| **0.1** | 243.9 | -0.99 | 235.037 | | -0.999 | 210.2 | -0.99 | 208.4 | -0.97 |
| **0.2** | 272.3 | -0.99 | 266.048 | | -0.998 | 169.6 | -0.98 | 228.2 | -1.0 |
| **0.3** | 218.8 | -0.97 | 250.335 | | -0.999 | 177.9 | -0.99 | 203.7 | 0.99 |
| **0.4** | 204.6 | -0.96 | 229.882 | | -1.0 | 157.7 | -0.98 | 190.6 | -0.98 |
| **0.5** | 214.0 | -0.95 | 236.450 | | -0.998 | 127.2 | -0.96 | 203.3 | -0.97 |
| **0.6**  **0.7**  **0.8**  **0.9** | 225.1  228.1  218.9  214.9 | -0.96  -0.99  -0.99  -0.99 | 255.905  268.459  263.138  265.300 | | -0.998  -0.998  -1.0  -0.997 | 108.9  102.2  119.6  142.4 | -0.93  -0.90  -0.94  -0.98 | 223.6  224.6  210.3  212.0 | -0.97  -0.97  -0.97  -0.98 |