Supporting Material

Multifunctional $Ti_3C_2T_x$-alginate foams for energy harvesting and fire warning

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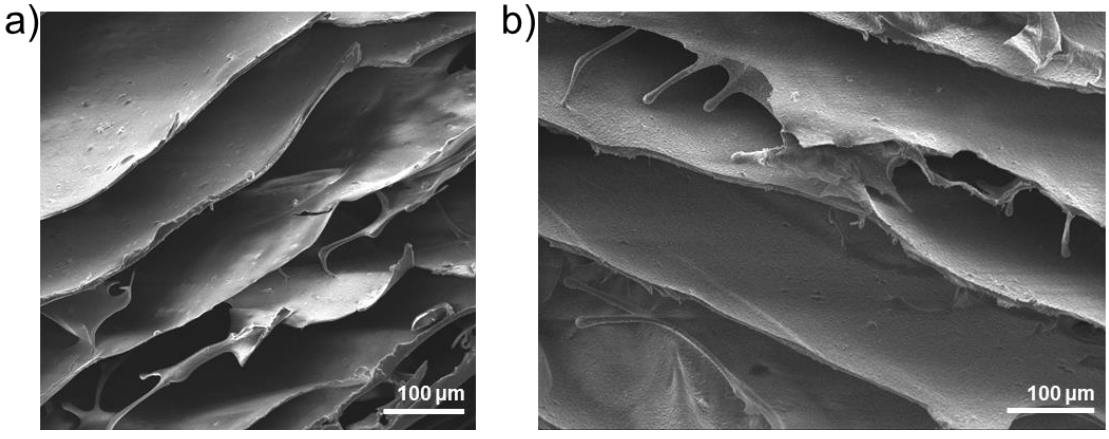

Figure S1. SEM cross-section images of a 2% $Ti_3C_2T_x$-alginate foam (a, b).

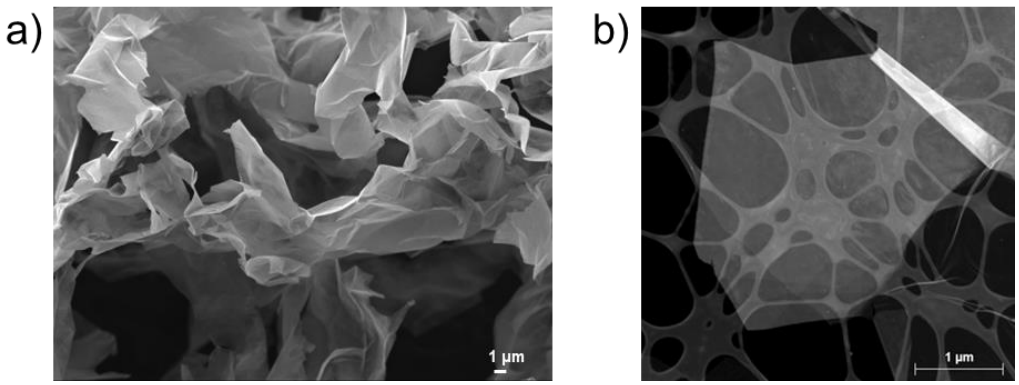

Figure S2. SEM (a) and TEM (b) images of $Ti_3C_2T_x$ flakes.

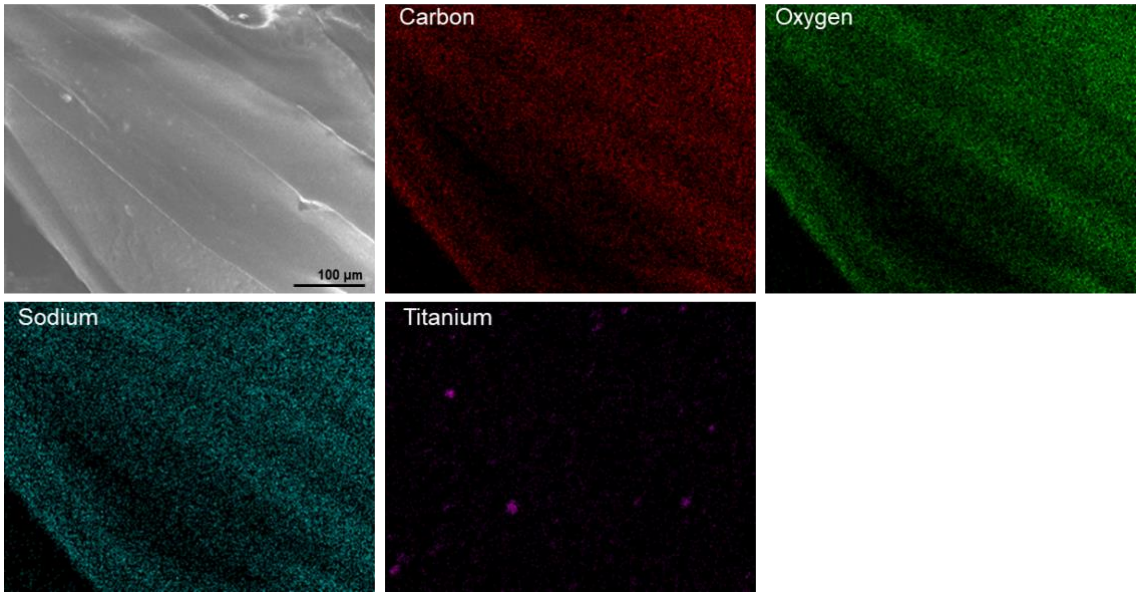

Figure S3. SEM image and EDX maps with the carbon, oxygen, sodium and titanium signals from a lamella of a 2%$Ti_3C_2T_x$-alginate foam. The presence of the MXene is confirmed by the Ti signal, showing some flakes at the surface of the lamella. The other signals originate from the sodium alginate polymer.

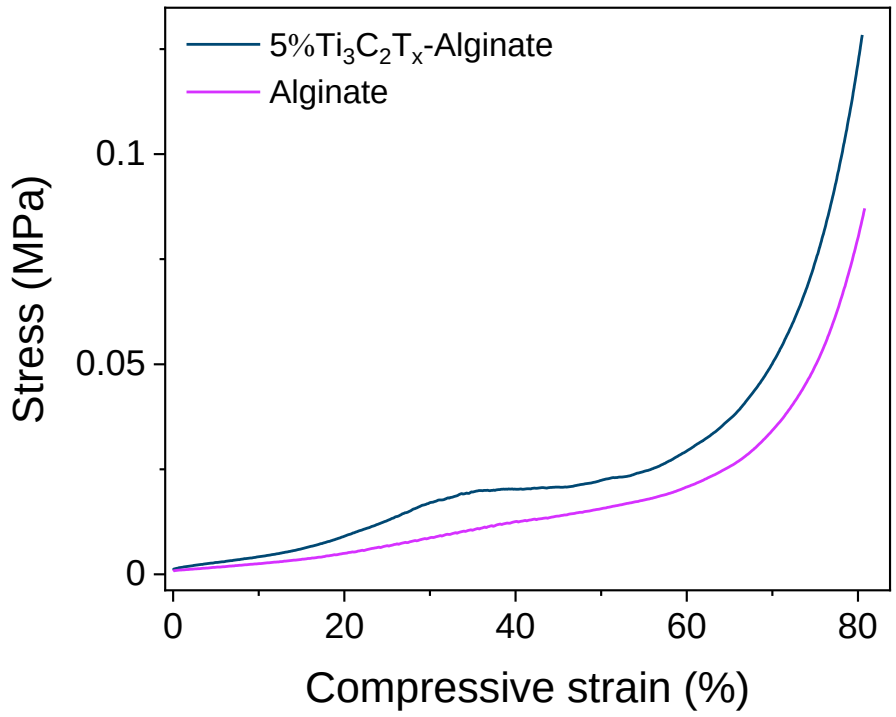

Figure S4. Stress-strain curves of alginate and 5%$Ti_3C_2T_x$-alginate foams.

Table S1. Summary of comparison with literature values for triboelectrical output, thermal conductivity and fire alarm trigger time.

Material	current (μA)	power (mW m^{-2})	thermal conductivity (mW m^{-1} K^{-1})	Trigger time (s)	Reference in main text
Polyurethane foam	2.2	5.2			14
Polyaniline foam	6.3	172			17
Micrometer-thin aerogels		100-20,000			10
expanded Polystyrene			35-45		35
Polymer-MXene composites				1-20	47, 48
5%$Ti_3C_2T_x$-Alginate foam	7.8	172	62	2	this work

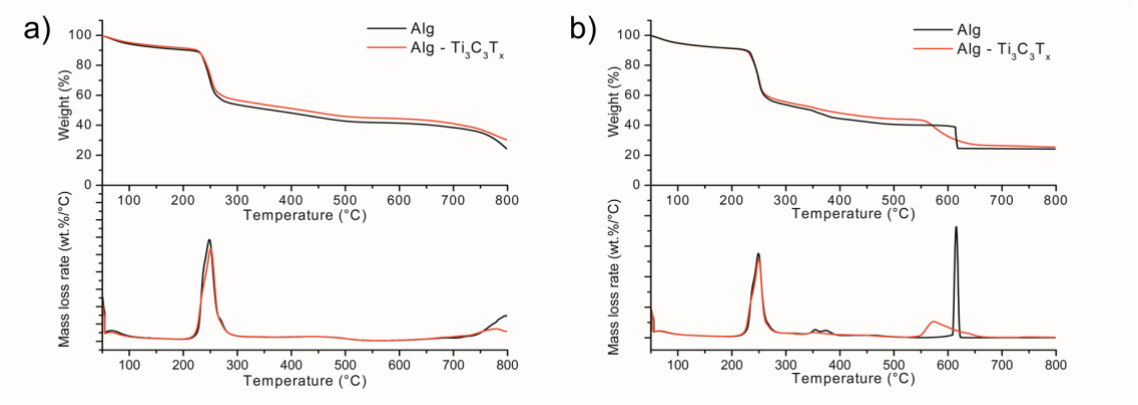

Figure S5. TG and DTG curves in nitrogen (a) and air (b) of alginate and 5%$Ti_3C_2T_x$-alginate foams.

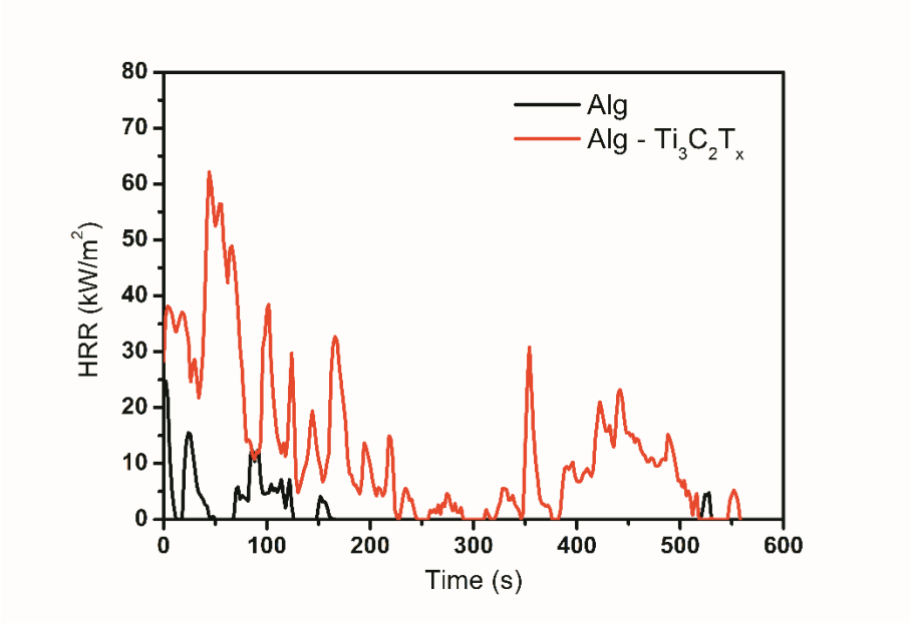

Figure S6. HRR plots of alginate and 5%$Ti_3C_2T_x$-alginate foams.

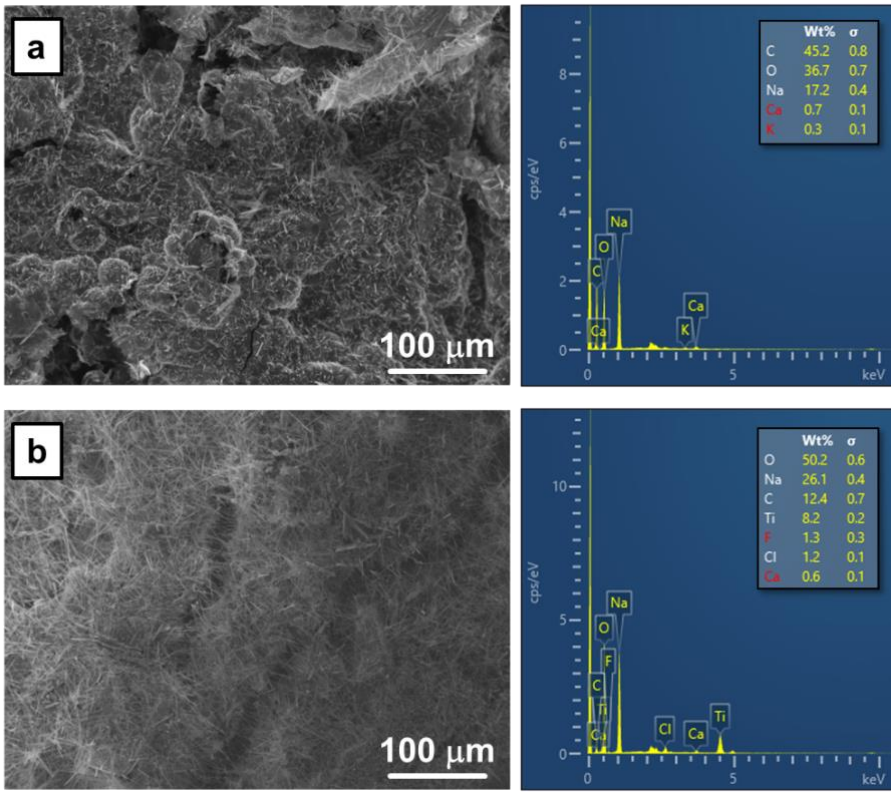

Figure S7. SEM images and EDX analyses of the residues collected at the end of the cone calorimetry test of alginate (a) and 5%$Ti_3C_2T_x$-alginate foams (b),

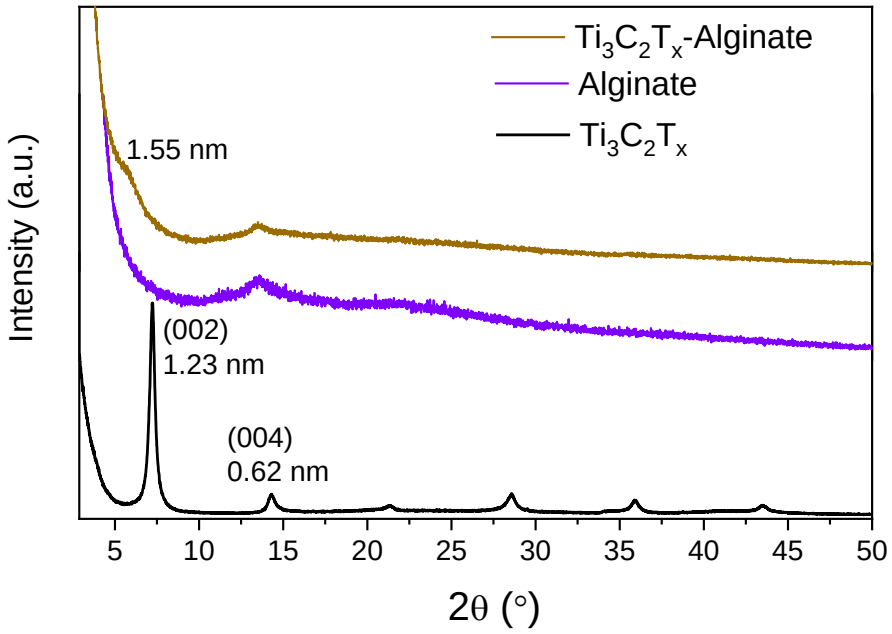

Figure S8. XRD pattern of $Ti_3C_2T_x$, alginate, and the composite. The (002) reflection of $Ti_3C_2T_x$ is visible as shoulder at 1.55 nm in the pattern of the composite.

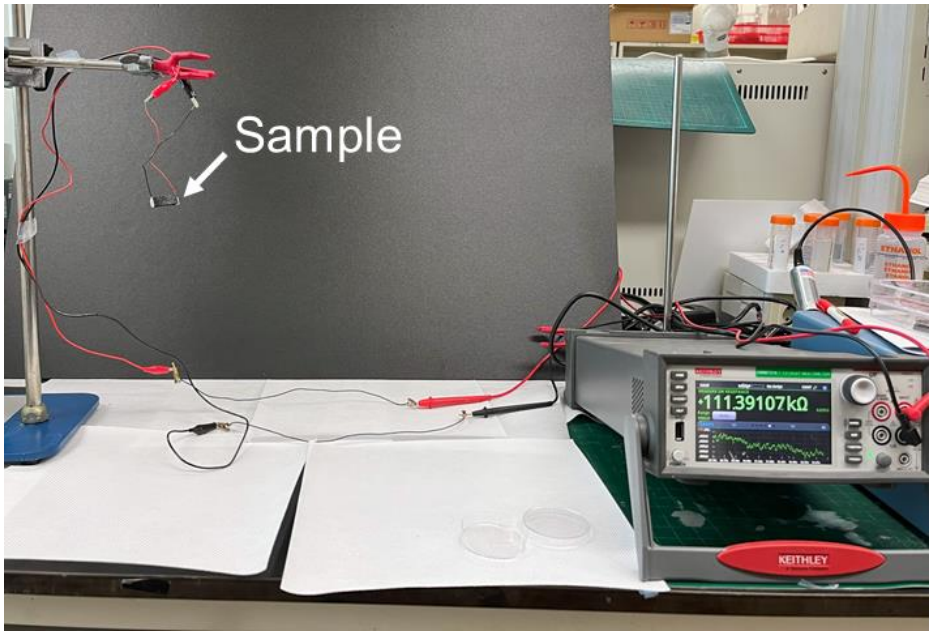

Figure S9: Setup of the resistance measurement across a foam sample.

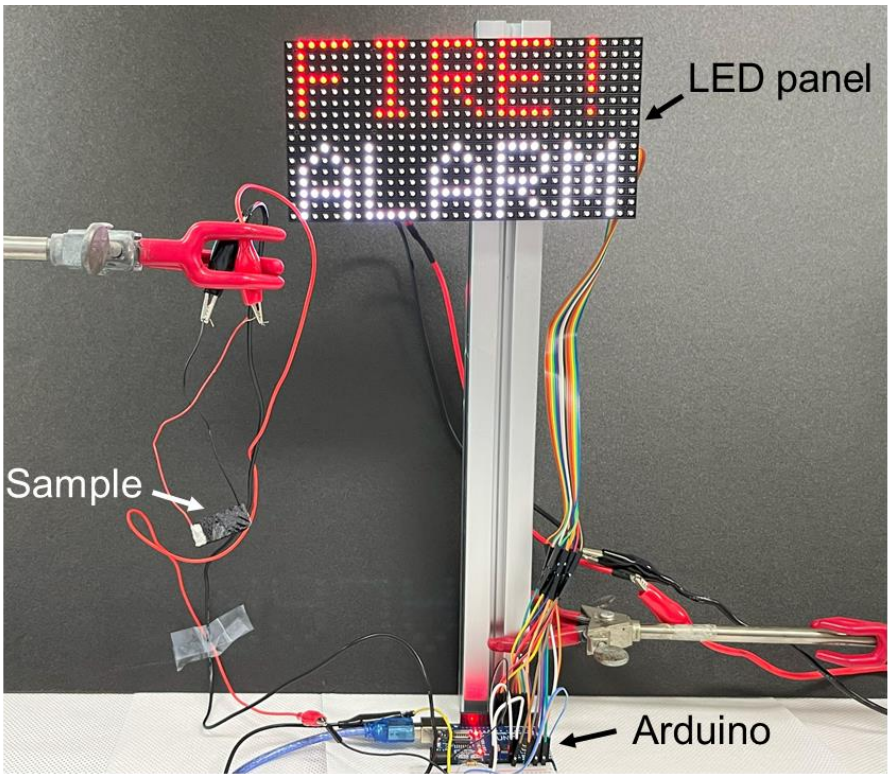

Figure S10: Setup of the fire alarm system consisting of the foam sample wired with silver paste to an Arduino that records the electrical resistance across the sample. The controller is set to trigger the LED panel at a relative resistance variation of 10 %.