Assessment of lithium vs sodium batteries

Future energy supply will undoubtedly need continued massive deployment of solar PV and wind electricity, which, as intermittent supplies, have to be complemented by storage technologies: mainly electrolysis and batteries. The Group of Energy Materials (GEM) is performing research on various electrolysis pathways (of water and steam) for *long term and larger scale* electricity storage (in the form of H_2, CH_4 or other fuels : power-to-gas). This will be complemented by batteries, specifically for *short term and smaller scale* electricity storage, as is already the case for the residential market (i.e. PV roof panels and a stationary battery in houses/buildings). Battery technology is increasingly dominated by lithium (owing to its light weight and the high voltage per cell), especially for mobility/portable application. However, the question of lithium availability arises. Yearly mining of lithium is soaring, with production at 130'000 t/yr in 2022. Estimated reserves are also increasing and now believed to be 86 million ton. If an average small car uses 4 kg of Li, this means that the present yearly production could theoretically equip 32 million EV/year. This compares to the yearly car market of >70 million, and leaves out of consideration all other mobility (buses, trucks, bikes,…) and all other Li uses, whether for the battery market (electronic devices) or other Li applications (additive to glasses & ceramics, lubricants, alloys, polymers, pharma,…). Hence there could be a Li supply bottleneck in future. Recycling will certainly help, but by definition (2nd Law of thermodynamics), recycling reduces quantity and quality of any material upon every cycle.
Sodium as next alkali metal in the periodic table is another battery candidate material, with somewhat less favorable properties than Li, but with the big advantage of abundance.

The purpose of this semester project is to perform an in-depth comparison of Li and Na battery technologies, and to define a strategy which research axes make most sense to pursue on either Li or Na, or both.

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