Supporting Information
Attainable Energy Density of Micro-Batteries

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The mass balance of the electrode materials was done using the relation given in equation S1; where m_a, Q_a, and m_c, Q_c correspond to the mass and practical capacity of anode and cathode materials, respectively. The studied cell chemistries are presented in Table S1. Each anode material was overloaded by the usual extra 20 wt% safety rule[1]. Since we designed the all-solid-state cells to be fabricated with solution processing, 3-7 wt% of each electrode was considered for binder and conductive additives where necessary. It was also assumed that there are neither kinetic limitations nor interfacial challenges in the cells.

$$m_a Q_a = m_c Q_c \quad (S1)$$

Table S1. Considered cell chemistries, voltages and areal capacities for calculating E_{vm}.

Acronym	Materials	Material Density (g cm^{-3})	Material Capacity (mAh g^{-1})	Cell Voltage (V)	Cell Capacity (mAh cm^{-2})
LFP/LTO	$LiFePO_4/Li_4Ti_5O_{12}$	3.6/3.73	160/170	2.0	4.85
LFP/C	$LiFePO_4$/Graphite	3.6/2.2	160/330	3.3	5.14
LFP/Li	$LiFePO_4$/Lithium	3.6/0.534	160/3862	3.5	7.26
NCM-111/LTO	$LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2/ Li_4Ti_5O_{12}$	4.7/3.73	150/170	2.2	5.34
NCA/LTO	$LiNi_{0.8}Co_{0.15}Al_{0.05}O_2/ Li_4Ti_5O_{12}$	4.7/3.73	186/170	2.2	5.88
NCA/C	$LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$/Graphite	4.7/2.2	186/330	3.6	6.36
NCA/Li	$LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$/Li	4.7/0.534	186/3862	3.7	9.90
Li-rich NCM/C-Si	$x Li_2MnO_3 \cdot [1-x]LiNiO_2$/Graphite-Silicon composite	4.7/2.21	280/600	3.5	10.58

The volumetric energy densities (E_{vm}) for the different cell chemistries, without considering packaging, were thus estimated using the relation given in equation S2. Where Q_L, m_L, V, w_i, ρ_i correspond to practical capacity of the limiting electrode (cathode) in mAh g^{-1}, mass loading of the limiting electrode (cathode) in g cm^{-2}, average cell voltage (V), mass of each cell component in g cm^{-2}, and density of each cell component (g cm^{-3}), respectively. The resulting volumetric energy densities (E_{vm}) are presented in Fig. S1; these values are without considering current collectors or packaging and are consistent with those previously reported in literature.[1-2]

$$E_{vm} = \frac{Q_L \cdot V \cdot m_L}{\sum {}^{w_i}/_{\rho_i}} \quad (S2)$$

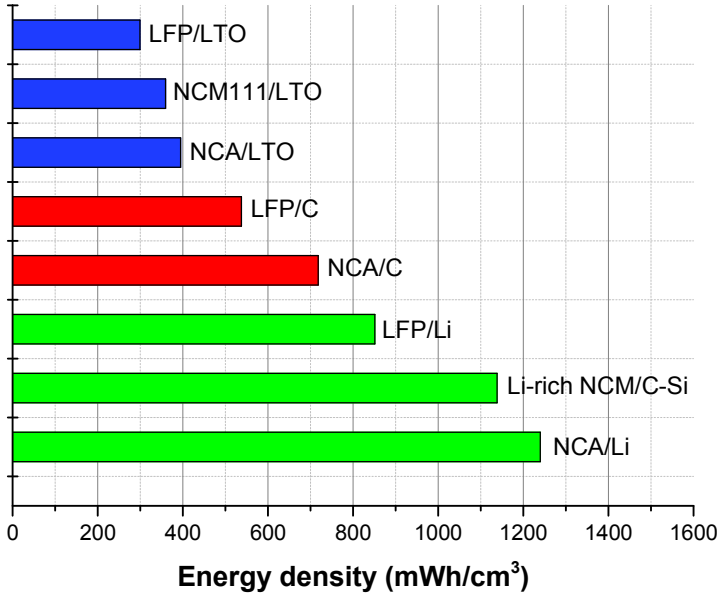

Fig. S1. Calculated volumetric energy densities (E_{vm}) for different cell chemistries without considering packaging.

References

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