Electronic Supplementary Information

One-Dimensional Nanostructures for Flexible Supercapacitors

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<table>
<thead>
<tr>
<th>Material</th>
<th>Capacity</th>
<th>Energy density</th>
<th>Power density</th>
<th>Cyclic stability</th>
<th>Ref</th>
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<tbody>
<tr>
<td>Carbon</td>
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<tr>
<td>PAN-derived CNFs</td>
<td>120 F g⁻¹ at 1 A g⁻¹</td>
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<td>57</td>
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<td>ZnCl₂-containing PAN nanofibers derived CNFs</td>
<td>140 F g⁻¹</td>
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<tr>
<td>Nafion/PAN co-electrospun nanofibers derived CNFs</td>
<td>210 F g⁻¹ at 1 A g⁻¹</td>
<td>4 W h kg⁻¹</td>
<td>20 kW kg⁻¹</td>
<td>No obvious decay after 500 cycles</td>
<td>62</td>
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<tr>
<td>PVA/phenolic resin based CNFs</td>
<td>200 F g⁻¹ at 1 A g⁻¹</td>
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<td>Over 92% after 1000 cycles</td>
<td>63</td>
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<tr>
<td>PPy coated and N-doped CNFs</td>
<td>202 F g⁻¹ at 1 A g⁻¹</td>
<td>7.11 W h kg⁻¹ (Max.)</td>
<td>89.57 kW kg⁻¹ (Max.)</td>
<td>~97% after 3000 cycles</td>
<td>66</td>
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<tr>
<td>Bacterial cellulose derived CNFs</td>
<td>77.76 F g⁻¹ at 1 A g⁻¹</td>
<td>32.91 W h kg⁻¹ (Max.)</td>
<td>284.63 kW kg⁻¹ (Max.)</td>
<td>~95.4% after 2000 cycles</td>
<td>41</td>
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<tr>
<td>Bacterial cellulose derived N-doped CNFs</td>
<td>186.6 F g⁻¹ at 1 A g⁻¹</td>
<td>6.07 W h kg⁻¹ (Max.)</td>
<td>390.53 kW kg⁻¹ (Max.)</td>
<td>95.9% after 5000 cycles</td>
<td>43</td>
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<tr>
<td>Bacterial cellulose derived N, P hetero-atom doped CNFs</td>
<td>204.9 F g⁻¹ at 1 A g⁻¹</td>
<td>7.76 W h kg⁻¹ (Max.)</td>
<td>186.03 kW kg⁻¹ (Max.)</td>
<td>No obvious decay after 4000 cycles</td>
<td>67</td>
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<tr>
<td>Metal oxides and hydroxides</td>
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<tr>
<td>WO₃-x@Au@MnO₂ nanowires</td>
<td>1195 F g⁻¹ at 0.75 A g⁻¹</td>
<td>78.1 W h kg⁻¹</td>
<td>36 kW kg⁻¹</td>
<td>No obvious decay after 5000 cycles</td>
<td>68</td>
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<tr>
<td>Mesoporous NiCo₂O₄ nanowire on carbon textiles</td>
<td>1283 F g⁻¹ at 1 A g⁻¹</td>
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<td>57% after 5000 cycles</td>
<td>70</td>
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<tr>
<td>Ni(OH)₂ nanowires</td>
<td>270 F g⁻¹ at 7.5 A g⁻¹</td>
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<td>71</td>
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<td>CNT films supported electrodeposited MnO₂ nanowires</td>
<td>300 F g⁻¹ at 0.77 A g⁻¹</td>
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<td></td>
<td>Over 88% after 3000 cycles</td>
<td>75</td>
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<td>MnO₂ nanowires/graphene nanocomposites</td>
<td>31.0 F g⁻¹ at 0.5 A g⁻¹</td>
<td>7 W h kg⁻¹</td>
<td>5 kW kg⁻¹</td>
<td>79% after 1000 cycles</td>
<td>76</td>
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<tr>
<td>MnO₂ nanorods on carbon textiles</td>
<td>109 mF cm⁻²</td>
<td>71 W h kg⁻¹</td>
<td>39 kW kg⁻¹</td>
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<td>MnO₂/PEDOT coaxial nanowires</td>
<td>210 F g⁻¹ at 5 mA cm⁻¹</td>
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<td>78</td>
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<tr>
<td>α-Fe₂O₃/MnO₂ core/shell nanowires</td>
<td>801 F g⁻¹ at 1 A g⁻¹</td>
<td>17 W h kg⁻¹</td>
<td>30.6 kW kg⁻¹</td>
<td>98.5% after 1500 cycles</td>
<td>79</td>
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<tr>
<td>Zn₂SnO₄/MnO₂ core/shell nanocable</td>
<td>642.4 F g⁻¹ at 1 A g⁻¹</td>
<td>36.8 W h kg⁻¹</td>
<td>32 kW kg⁻¹</td>
<td>98.8% after 1000 cycles</td>
<td>80</td>
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<tr>
<td>CuO@MnO₂</td>
<td>49.2 F g⁻¹ at 0.25 A</td>
<td>22.1 W h kg⁻¹</td>
<td>85.6 kW kg⁻¹</td>
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<td>81</td>
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<tr>
<td>Architecture</td>
<td>g(^{-1}) at</td>
<td>(Max.)</td>
<td>(Max.)</td>
<td>10000 cycles</td>
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<td>--------------------------------------</td>
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<tr>
<td>Co(_3)O(_4) nanowire@MnO(_2)</td>
<td>0.56 F cm(^{-2})</td>
<td>11.25 mA cm(^{-2})</td>
<td>10000 cycles</td>
<td>97.3% after 5000 cycles</td>
<td></td>
</tr>
<tr>
<td>Co(_3)O(_4@Pt)</td>
<td>539 F g(^{-1}) at 1 A g(^{-1})</td>
<td>39.6 W h kg(^{-1})</td>
<td>19.6 kW kg(^{-1})</td>
<td>105.6% after 5000 cycles</td>
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<tr>
<td>MnO(_2) nanowire arrays</td>
<td>1260.9 F g(^{-1})</td>
<td>0.04 mW h cm(^{3})</td>
<td>87.5% after 10000 cycles</td>
<td></td>
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<tr>
<td>ZnO core-shell nanocables</td>
<td>449.6 F g(^{-1}) at 10 mV s(^{-1})</td>
<td>6.3 W h kg(^{-1})</td>
<td>20.4 kW kg(^{-1}) (Max.)</td>
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<tr>
<td>H-TiO(_2)@MnO(_2) core-shell nanowires</td>
<td>334.7 F g(^{-1}) at 1 A g(^{-1})</td>
<td>11.8 W h kg(^{-1})</td>
<td>99.8% after 2000 cycles</td>
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<tr>
<td>Co(_3)O(_4)@Pt@MnO(_2) nanowire arrays</td>
<td>2223 F g(^{-1})</td>
<td>11.8 W h kg(^{-1})</td>
<td>5.5 kW kg(^{-1})</td>
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<td>Co(_3)O(_4)/NiO core/shell nanowire arrays</td>
<td>1525 F g(^{-1}) at 1 A g(^{-1})</td>
<td>81 W h kg(^{-1})</td>
<td>71 kW kg(^{-1})</td>
<td>–91-94% after 5000 cycles</td>
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<td>MnO(_2)/Pt/MnO(_2) sandwich-structured nanotube arrays</td>
<td>978 F g(^{-1}) at 2 A g(^{-1})</td>
<td>45 W h kg(^{-1})</td>
<td>23 kW kg(^{-1})</td>
<td>Over 90% after 2000 cycles</td>
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<tr>
<td>3D Co@Polypyrrole nanowire array</td>
<td>853 F g(^{-1}) at 2 A g(^{-1})</td>
<td>45 W h kg(^{-1})</td>
<td>23 kW kg(^{-1})</td>
<td>95% after 3000 cycles</td>
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<td>Mesoporous CoO nanowires</td>
<td>3181 F g(^{-1}) at 2 mA cm(^{-2})</td>
<td>6.21 W h kg(^{-1})</td>
<td>2.21 kW kg(^{-1})</td>
<td>About 83% after 3000 cycles</td>
<td></td>
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<tr>
<td>Reduced mesoporous Co(_3)O(_4) nanowires</td>
<td>1118.6 F g(^{-1})</td>
<td>11.8 W h kg(^{-1})</td>
<td>5.5 kW kg(^{-1})</td>
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<td>Co(_3)O(_4)/NiO core/shell nanowire arrays</td>
<td>1.64 F cm(^{-2}) at 2 mA cm(^{-2})</td>
<td>33 W h kg(^{-1})</td>
<td>41.25 kW kg(^{-1})</td>
<td>81.3% after 2000 cycles</td>
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<tr>
<td>Co(_3)O(_4)/NiO nanoneedle arrays</td>
<td>180.4 F cm(^{-1}) at 1 mA cm(^{-2})</td>
<td>277.3 mF cm(^{-2}) at 10 mV s(^{-1})</td>
<td>95.2% after 10000 cycles</td>
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<td>Oxygen-deficient hematite nanorods</td>
<td>278 mAh g(^{-1}) at 1 A g(^{-1})</td>
<td>96% after 1000 cycles</td>
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<td>Fe(_2)O(_3) nanorods on graphene foam/CNT hybrid film</td>
<td>~500 C g(^{-1}) at 1 mV s(^{-1})</td>
<td>500 mF cm(^{-2}),</td>
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<td>CNT/V(_2)O(_5) nanowire</td>
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<td>WO(_3)−x/MoO(_3)−x core/shell nanowires on carbon fabric</td>
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### Metal chalcogenides and nitrides

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<tr>
<th>Material</th>
<th>Specific Capacity</th>
<th>Power Density</th>
<th>Energy Density</th>
<th>Cycles</th>
<th>Efficiency</th>
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<tbody>
<tr>
<td>Ni₃S₂/CNT</td>
<td>514 F g⁻¹ at 4 A g⁻¹</td>
<td>88% after 1500 cycles</td>
<td>98</td>
<td>25</td>
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<td>Co₈S₈ nanorod arrays grown on carbon textiles</td>
<td>2.35 F cm⁻² at 5 mV s⁻¹</td>
<td>78.5% after 3000 cycles</td>
<td>99</td>
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<tr>
<td>Ni-Co sulfide nanowires grown on Ni foam</td>
<td>2415 F g⁻¹ at 2.5 mA cm⁻²</td>
<td>96% after 2000 cycles</td>
<td>100</td>
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<tr>
<td>NiCo₃S₄ nanotube arrays grown on carbon fiber paper</td>
<td>2.86 F cm⁻² at 4 mA cm⁻²</td>
<td>88% after 1500 cycles</td>
<td>48</td>
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<tr>
<td>Three-dimensional CoSe₂/carbon cloth</td>
<td>332 mF cm⁻² at 1 mA cm⁻²</td>
<td>95.4% after 5000 cycles</td>
<td>101</td>
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<tr>
<td>Hollow Co₀.₈₅Se nanowire array on carbon fiber paper</td>
<td>674 F g⁻¹ at 1.48 A g⁻¹</td>
<td>89% after 2000 cycles</td>
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<tr>
<td>TiN nanowire arrays</td>
<td>0.33 F cm⁻³</td>
<td>0.05 mW h cm⁻³ (Max.)</td>
<td>82% after 15000 cycles</td>
<td>48</td>
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<tr>
<td>Porous VN nanowire</td>
<td>298.5 F g⁻¹ at 10 mV S⁻¹</td>
<td>95.3% after 10000 cycles</td>
<td>103</td>
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<tr>
<td>Three-dimensional arrays of VN functionalized CNTs</td>
<td>289 F g⁻¹ at 20 mV S⁻¹</td>
<td>96% after 2000 cycles</td>
<td>100</td>
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### Polymeric materials

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<th>Specific Capacity</th>
<th>Power Density</th>
<th>Energy Density</th>
<th>Cycles</th>
<th>Efficiency</th>
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<tbody>
<tr>
<td>PANI nanowire arrays on GO sheets</td>
<td>555 F g⁻¹ at 0.2 A g⁻¹</td>
<td>92% after 2000 cycles</td>
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<tr>
<td>Graphene/PANI composite film</td>
<td>385 F g⁻¹ at 0.5 A g⁻¹</td>
<td>90% after 5000 cycles</td>
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<tr>
<td>PANI nanorods on RGO</td>
<td>970 F g⁻¹ at 2.5 A g⁻¹</td>
<td>90% after 1700 cycles</td>
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<td>PANI nanowires/carbon cloth</td>
<td>1079 F g⁻¹</td>
<td>100.9 W h kg⁻¹</td>
<td>86% after 2100 cycles</td>
<td>111</td>
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<td>PANI nanowire array/SWCNT composites</td>
<td>410 F g⁻¹</td>
<td>26.6 W h kg⁻¹</td>
<td>7 kW kg⁻¹</td>
<td>90% after 3000 cycles</td>
<td>112</td>
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<tr>
<td>All-solid-state paperlike PANI/CNT film</td>
<td>350 F g⁻¹</td>
<td>7.1 W h kg⁻¹</td>
<td>2.189 kW kg⁻¹</td>
<td>91.9% after 1000 cycles</td>
<td>113</td>
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<tr>
<td>Ultrathin free-standing SWCNT/PANI films</td>
<td>236 F g⁻¹</td>
<td>131 W h kg⁻¹</td>
<td>62.5 kW kg⁻¹</td>
<td>85% after 1000 cycles</td>
<td>114</td>
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<tr>
<td>PANI@C and PPy@C nanowires</td>
<td>189.73 F g⁻¹ and 114.08 F g⁻¹</td>
<td>95% and 85% after 10000 cycles.</td>
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<tr>
<td>TiO₂@PPy nanowires</td>
<td>64.6 mF cm⁻² at 10 mV s⁻¹</td>
<td>0.013 mW h cm⁻³</td>
<td>91.7% after 2000 cycles</td>
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### Other materials

<table>
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<tr>
<th>Material</th>
<th>Specific Capacity</th>
<th>Power Density</th>
<th>Energy Density</th>
<th>Cycles</th>
<th>Efficiency</th>
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<tbody>
<tr>
<td>1D silver nanowires</td>
<td>213 F g⁻¹</td>
<td>4.5 W h kg⁻¹</td>
<td>5.04 kW kg⁻¹</td>
<td>&gt;90% after 10000 cycles</td>
<td>23</td>
</tr>
<tr>
<td>Three-dimensional hierarchical GeSe₂</td>
<td>300 F g⁻¹ at 1 A g⁻¹</td>
<td>99.3% after 2000 cycles</td>
<td>116</td>
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Table S2. Comparison of electrochemical performances and flexibilities of the reported 1D nanomaterial-based flexible supercapacitors

<table>
<thead>
<tr>
<th>Structure</th>
<th>Capacity</th>
<th>Energy density</th>
<th>Power density</th>
<th>Cyclic stability</th>
<th>Flexibility</th>
<th>Ref</th>
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<td><strong>Sandwich-type flexible SCs</strong></td>
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<tr>
<td>SWCNT//SWCNT</td>
<td>120 F g⁻¹</td>
<td>6 W h kg⁻¹</td>
<td>70 kW kg⁻¹</td>
<td></td>
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<td>12</td>
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<tr>
<td>Symmetric MnO₂ nanorods/carbon nanoparticles SC</td>
<td>4.8 W h kg⁻¹</td>
<td>14 kW kg⁻¹</td>
<td></td>
<td>97.3% after 10000 cycles</td>
<td></td>
<td>77</td>
</tr>
<tr>
<td>H-TiO₂@MnO₂ //H-TiO₂@C</td>
<td>139.6 F g⁻¹</td>
<td>59 W h kg⁻¹</td>
<td>45 kW kg⁻¹</td>
<td>91.2% after 5000 cycles</td>
<td>Bendable and twistable</td>
<td>74</td>
</tr>
<tr>
<td>PANi/(WO₃₋ₓ/MoO₃₋ₓ core/shell nanowires)</td>
<td>216 mF cm⁻²</td>
<td>0.0019 W h cm⁻³</td>
<td>0.73 W cm⁻³</td>
<td>75% after 10000 cycles</td>
<td></td>
<td>73</td>
</tr>
<tr>
<td>VO₄ nanowires//VN nanowires</td>
<td>1.35F cm⁻³</td>
<td>0.61 mW h cm⁻³</td>
<td>0.85 W cm⁻³</td>
<td>87.5% after 10000 cycles</td>
<td>Bendable</td>
<td>103</td>
</tr>
<tr>
<td><strong>Wire-shaped flexible SCs</strong></td>
<td></td>
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<tr>
<td>ZnO nanowire-fiber</td>
<td>2.4 mF cm⁻²</td>
<td>10⁻⁴ W h cm⁻²</td>
<td>0.1 W cm⁻²</td>
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<td>13</td>
</tr>
<tr>
<td>Ni(OH)₂ nanowires//mesoporous carbon</td>
<td>35.67 mF cm⁻²</td>
<td>0.01 W h cm⁻²</td>
<td>7.3 W cm⁻²</td>
<td>70% after 10000 cycles</td>
<td>Bendable</td>
<td>71</td>
</tr>
<tr>
<td>Twisted CNT fibers</td>
<td>13.31 F g⁻¹</td>
<td>92.84 mW h cm⁻³</td>
<td>3.87 W cm⁻³</td>
<td>97% after 1000 cycles</td>
<td></td>
<td>118</td>
</tr>
<tr>
<td>Bisrolled yarn</td>
<td>179 F cm⁻³</td>
<td>1.4 mW h cm⁻³</td>
<td>40 W cm⁻³</td>
<td>99% after 10000 cycles</td>
<td>knittable</td>
<td>119</td>
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<tr>
<td>CNT yarns dotted with Co₃O₄</td>
<td>52.6 mF cm⁻²</td>
<td>1.10 µWh cm⁻²</td>
<td>0.01 mW cm⁻²</td>
<td>96% after 1000 cycles</td>
<td>Bendable</td>
<td>120</td>
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<tr>
<td>PANI coated CNT yarns</td>
<td>38 mF cm⁻²</td>
<td></td>
<td></td>
<td>91% after 800 cycles</td>
<td>Bendable</td>
<td>30</td>
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<tr>
<td>Coaxial CNT fiber SCs</td>
<td>59 F g⁻¹</td>
<td>1.88 W h kg⁻¹</td>
<td>755.9 W kg⁻¹</td>
<td>No obvious decay after 11000 cycles</td>
<td>Bendable and knittable</td>
<td>121</td>
</tr>
<tr>
<td><strong>Stretchable CNT fiber SCs</strong></td>
<td>20 F g⁻¹</td>
<td>0.363 Wh kg⁻¹</td>
<td>421 W kg⁻¹</td>
<td>90% after 1000 cycles</td>
<td>Bendable and stretchable</td>
<td>122</td>
</tr>
<tr>
<td>Electrochromic PANI coated CNT fiber SCs</td>
<td>255.5 F g⁻¹</td>
<td>12.75 Wh kg⁻¹</td>
<td>1494 W kg⁻¹</td>
<td>93.8% after 1000 cycles</td>
<td>Bendable and stretchable</td>
<td>123</td>
</tr>
<tr>
<td>Stretchable CNT fiber SCs (per-stretched)</td>
<td>30.7 F g⁻¹</td>
<td></td>
<td></td>
<td>99% after 1000 cycles</td>
<td>Stretchable</td>
<td>124</td>
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<tr>
<td>Superalastic CNT fiber SCs</td>
<td>105.8 F g⁻¹</td>
<td></td>
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<td>90% after 2000 cycles</td>
<td>Bendable and stretchable</td>
<td>125</td>
</tr>
<tr>
<td>Chip-type Flexible SCs</td>
<td>Properties</td>
<td>Efficiency</td>
<td>Lifespan</td>
<td>Notes</td>
<td></td>
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<tr>
<td>PANI nanorods on RGO patterns</td>
<td>970 F g⁻¹</td>
<td>90% after 1700 cycles</td>
<td></td>
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</tr>
<tr>
<td>Nanoporous gold/manganese oxide nanowires</td>
<td>55 µW h cm⁻³</td>
<td>81% after 10000 cycles</td>
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<tr>
<td>3D graphene/CNT carpet</td>
<td>3.93 mF cm⁻²</td>
<td>98.4% after 8000 cycles</td>
<td></td>
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<tr>
<td>PANI nanowires</td>
<td>588 F cm⁻³</td>
<td>96% after 1000 cycles</td>
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<tr>
<td>Carbon/MnO₂ core/shell fibers</td>
<td>2.5 F cm⁻³ at 0.02 A cm⁻³</td>
<td>84% after 10000 cycles</td>
<td></td>
<td>Bendable</td>
<td></td>
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</tr>
<tr>
<td>Planar-integrated fiber SCs</td>
<td>650 mF g⁻¹</td>
<td>94% after 1000 cycles</td>
<td></td>
<td>Bendable</td>
<td></td>
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</tr>
</tbody>
</table>

Note: Max. indicates maximum power density.