Supporting Information for:
Kinetic Investigation of Solar Chemical Looping Reforming of Methane over Ni-CeO$_2$ at Low Temperature

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Figure S1. PXRD patterns for noncatalyzed CeO$_2$ (black), Ni-CeO$_2$ after synthesis (red), Ni-CeO$_2$ following the first reduction (yellow), and Ni-CeO$_2$ after 200 CLRM cycles at 700 °C (purple) over 2θ ranges of a) 20-90° and b) 35-65°. Alignment of peaks with patterns for NiO (diamonds) or Ni (circles) are indicated in subfigure b. Note all scans were collected for LP CeO$_2$ or LP Ni-CeO$_2$. 

Figure S2. Particle size distribution for a) CeO$_2$ and b) Ni-CeO$_2$ powder samples displayed as normalized volume versus the geometric diameter.
Figure S3. Specific molar rate of monatomic oxygen absorbed by the sample, determined from the derivative of the mass change, and specific molar flow rate of CO measured during oxidation of a) CeO$_2$ and b) Ni-CeO$_2$ during isothermal cycling at 800 °C.
Figure S4. SEM images, EDS element mappings (Ni: blue, Ce: green), and EDS Ni mapping overlayed with SEM imaging for LP Ni-CeO$_2$ a) after synthesis at 5,000x magnification, b) post cycling at 5,000x magnification, c) post cycling at 30,000x magnification, and d) post cycling at 80,000x magnification.