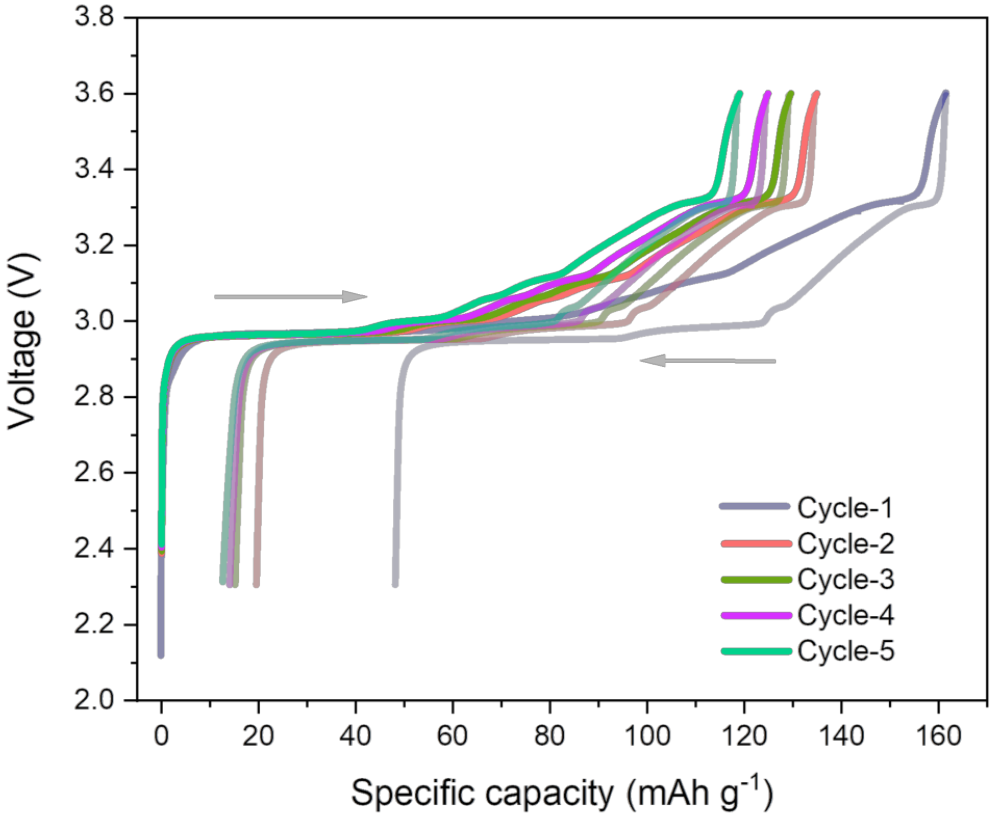
Supplementary Information: Probing Electrochemical Strain Generation in Sodium Chromium Oxide ($NaCrO_2$) Cathode in Na-ion Batteries during Charge/Discharge

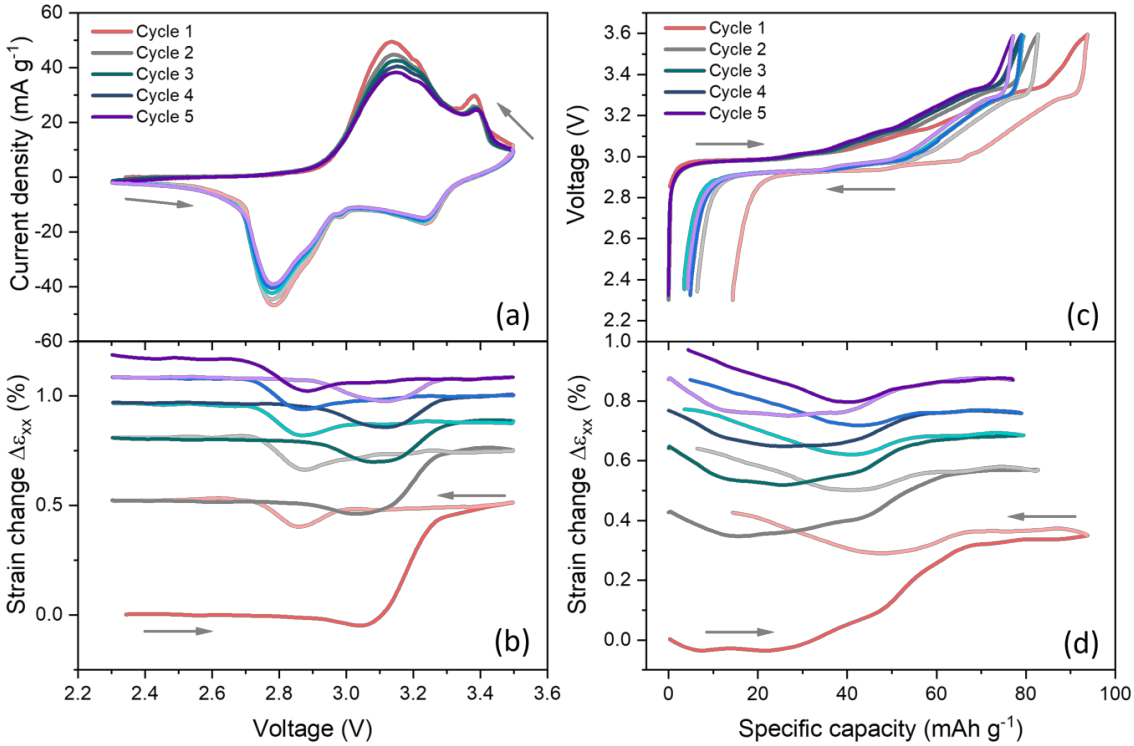
Minal Wable[1,2], Batuhan Bal[1], Ömer Özgür Capraz[1,2 *]

1. School of Chemical Engineering, Oklahoma State University, Stillwater, OK, 74078 USA
2. Chemical, Biochemical and Environmental Engineering, The University of Maryland – Baltimore County, Baltimore, MD 21250 USA

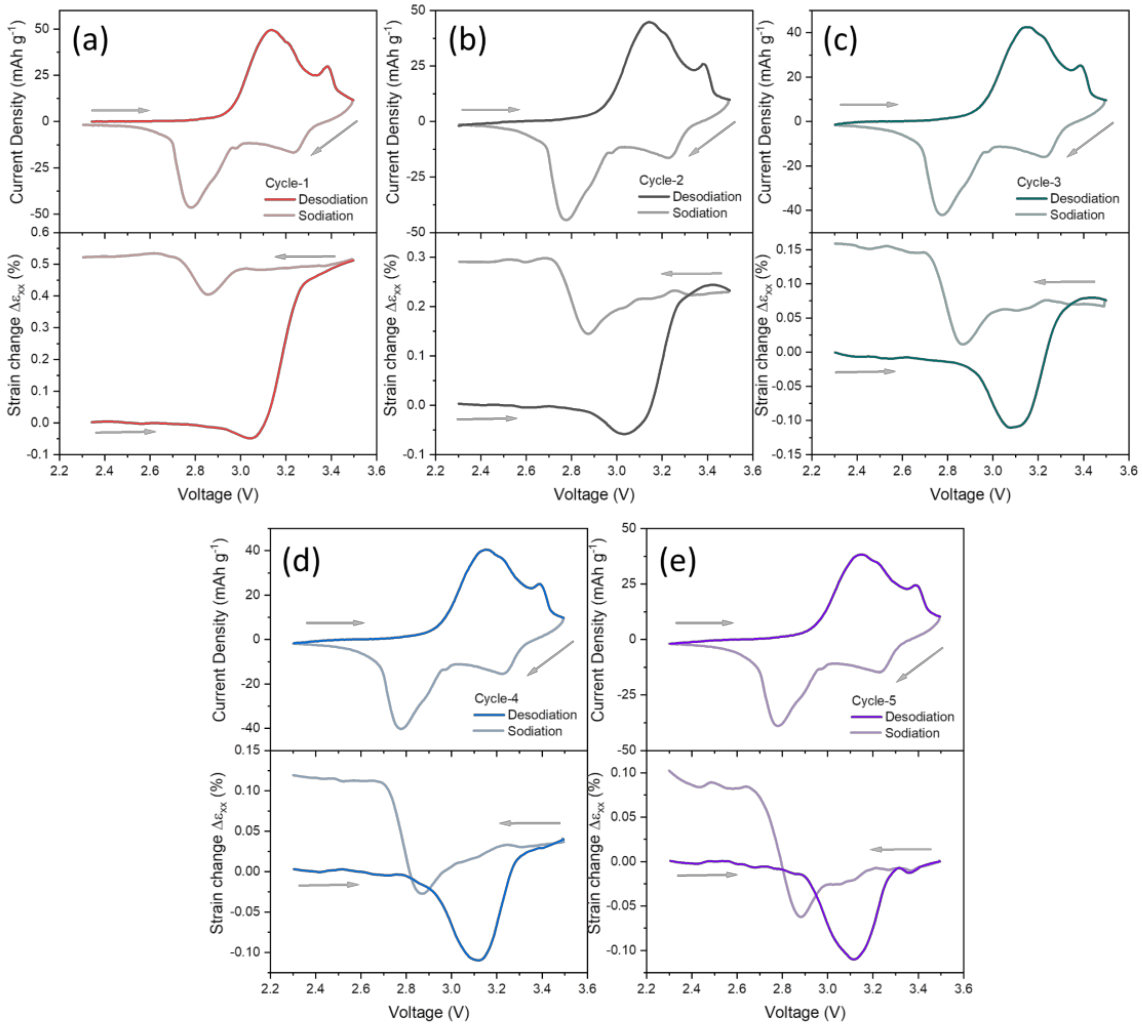
*Corresponding Author: Ömer Özgür Capraz and E-mail: capraz@umbc.edu



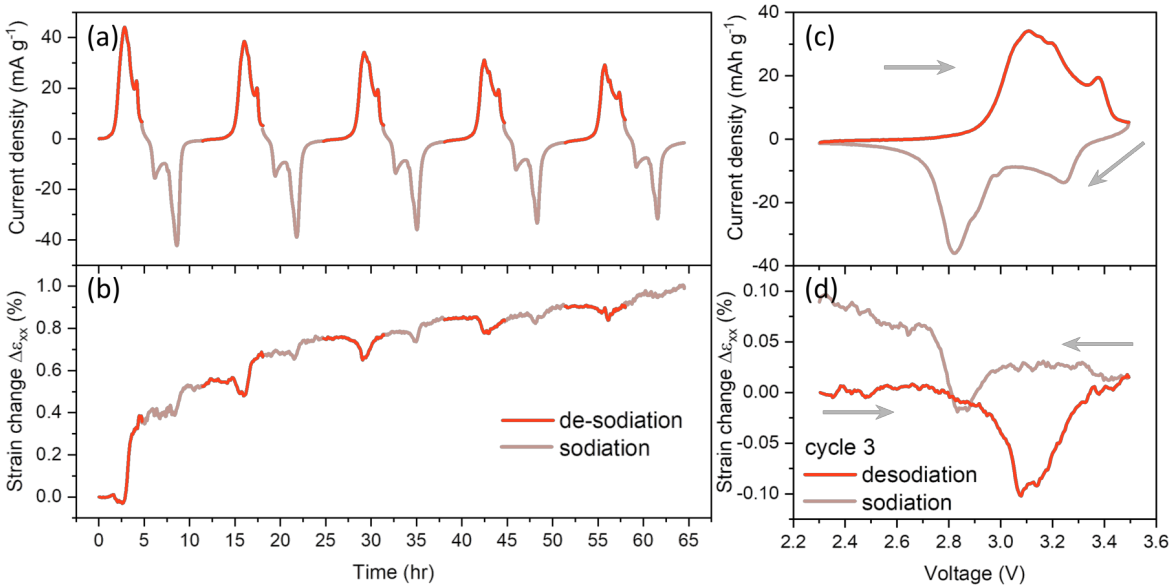
Supplementary Figure 1. Galvanostatic charge-discharge profiles of $NaCrO_2$ | Na in coin cell assembly cycled between 2.3 V to 3.6 V at C/25 current rate for initial 5 cycles.



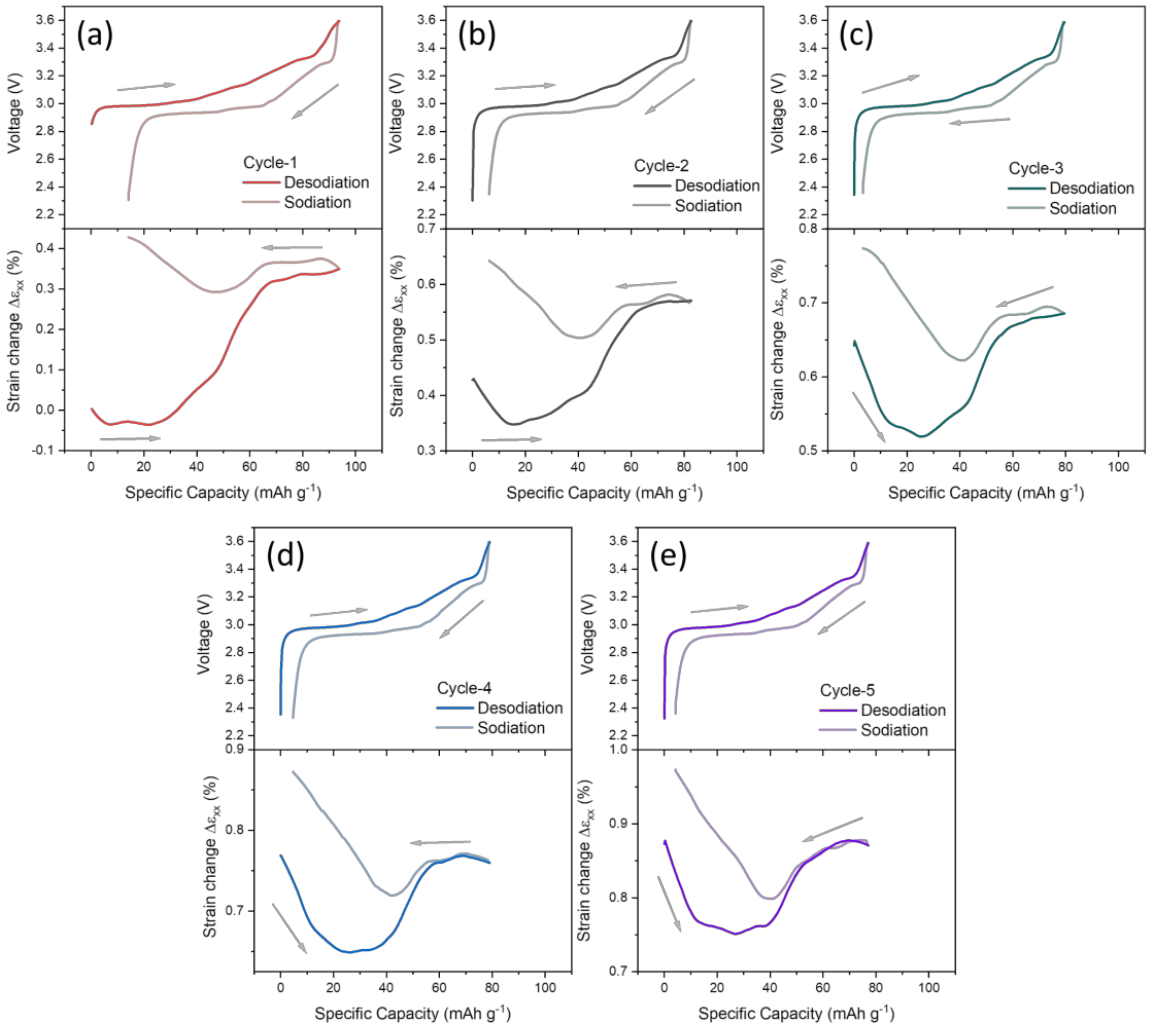
Supplementary Figure 2. a. The cyclic voltammetry of $NaCrO_2$ | Na cells from 2.3 to 3.5 V shows current density and b. corresponding strain generation in $NaCrO_2$ for the initial 5 cycles. c. the galvanostatic charge-discharge voltage profile and d. strain evolution of $NaCrO_2$ cathode during cycling between 2.3 V - 3.6 V for an initial five cycles.



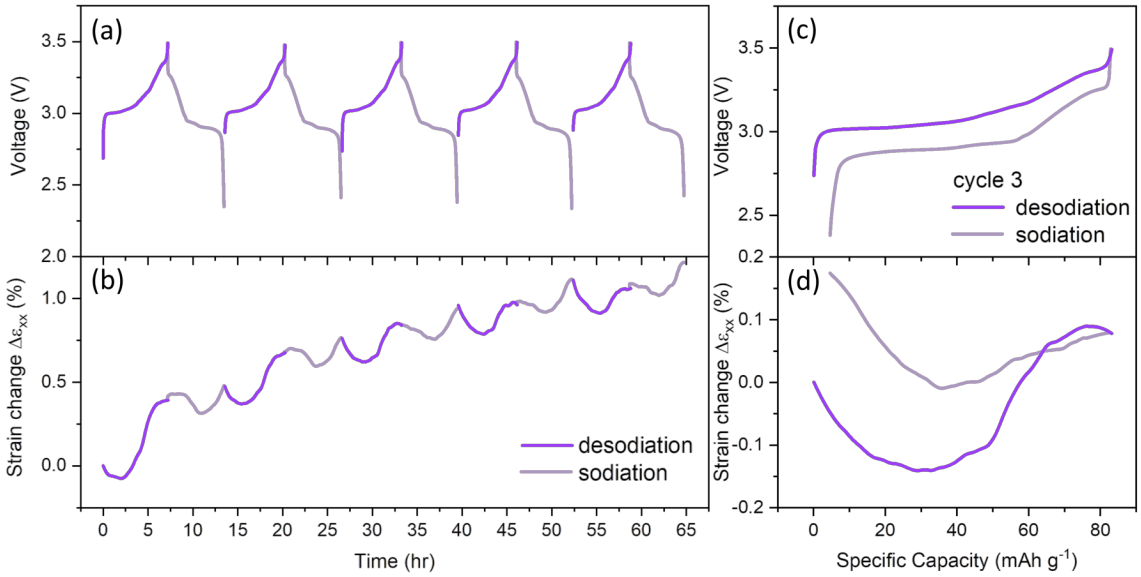
Supplementary Figure 3. (a-e) Current density and strain profile for each cycle from 2.3 V to 3.6 V in cyclic voltammetry at a scan rate of 50 μV/s.



Supplementary Figure 4. Repeated cyclic voltammetry experimental data (a) current density and (b) strain evolution of $NaCrO_2$ cathode w.r.t time at scan rate of 50 μV/s during cycling between 2.3 V - 3.5 V for initial five cycles. (c) current density and (d) strain evolution w.r.t voltage in the third cycle resetting strain to zero.



Supplementary Figure 5. (a-e) Voltage and strain profile for each cycle from 2.3 V to 3.6 V in galvanostatic cycling at current rate of C/25.



Supplementary Figure 6. Repeated galvanostatic cycling experimental data (a) voltage profile and (b) strain evolution of $NaCrO_2$ cathode during cycling between 2.3 V - 3.5 V for initial five cycles. (c) voltage profile and (d) strain evolution w.r.t specific capacity in the third cycle resetting strain to zero.