## **Electronic Supporting Information (ESI) file for**

## Lattice distortion of current collector upon supporting dimensional changes of electrode-active materials during lithiation/delithiation

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Fig. S1. Raman spectrum obtained with few layers graphene (FLG) film grown on Cu foil via atmospheric pressure CVD method; showing good quality of the FLG film; having  $I_d/I_g$  of just ~0.10.



Fig. S2. Potential profiles corresponding to the 1<sup>st</sup>, 2<sup>nd</sup>, 5<sup>th</sup>, 10<sup>th</sup>, 25<sup>th</sup> and 50<sup>th</sup> galvanostatic discharge/charge cycles in Li 'half-cells' for a-Si electrodes (a) directly on Cu foil and (b) on graphene-coated Cu foil.



Fig. S3. Cross-section TEM images (using, JEOL 2010FS) obtained with a-Si film electrodes having (sequentially) a-Si/Ni/Cr films on quartz substrate (for allowing *in-situ* stress measurements during electrochemical cycling, as reported in ref. [6]), imaged (a) before electrochemical cycling and (b) after 40 galvanostatic lithiation/delithiation cycles of a-Si film in Li 'half-cell'.



Fig. S4. X-ray diffraction patterns (using, Rigaku Smartlab X-ray diffractometer), showing the (111) peak of Ni current collector film of a-Si/Ni/Cr film electrodes on quartz substrate (as used for *in-situ* stress measurements during electrochemical cycling, as per ref. [6]), obtained (a) before electrochemical cycling and (b) after 40 galvanostatic lithiation/delithiation cycles of the a-Si film in Li 'half-cell'.



Fig. S5. Inverse Pole Figure (IPF) maps recorded with (a) Cu foil prior to being used for electrochemical cycling of a-Si (sans any interlayer between a-Si and Cu) (upon removal of asdeposited Si), (b) Cu foil after being used for 50 galvanostatic lithiation/delithiation cycles of a-Si (sans any interlayer between a-Si and Cu) (upon removal of remaining Si), (c) few layers graphene (FLG) coated Cu foil (upon removal of graphene and Si), prior to being used for 50 galvanostatic lithiation/delithiation cycles of a-Si and (d) FLG-coated Cu foil after being used for 50 galvanostatic lithiation/delithiation cycles of a-Si (upon removal of graphene and Si). The inset presents color coding that indicates the out-of-plane directions associated with the IPF.



Fig. S6. The distribution (as area fraction) of grains having certain sizes for (a) Cu foil prior to being used for electrochemical cycling of a-Si (sans any interlayer between a-Si and Cu) (upon removal of as-deposited Si), (b) Cu foil after being used for 50 galvanostatic lithiation/delithiation cycles of a-Si (sans any interlayer between a-Si and Cu) (upon removal of remaining Si), (c) few layers graphene (FLG) coated Cu foil (upon removal of graphene and Si), prior to being used for electrochemical cycling of a-Si and (d) FLG-coated Cu foil after being used for 50 galvanostatic lithiation/delithiation cycles of a-Si (sans and cycling of a-Si and Cu) (upon removal of graphene and Si).

On a different note, the overall larger grain size of the Cu foil coated with graphene is due to the grain growth incurred during the graphene deposition step at 1000 °C. In general, larger grain size is known to accrue plastic deformation, unlike as seen here due to protection from the graphene-based coating (*viz.*, 'buffer' interlayer).