Supporting Information

# Effect of Fe and Mn Substitution in LaNiO₃ on Exsolution, Activity and Stability for Methane Dry Reforming

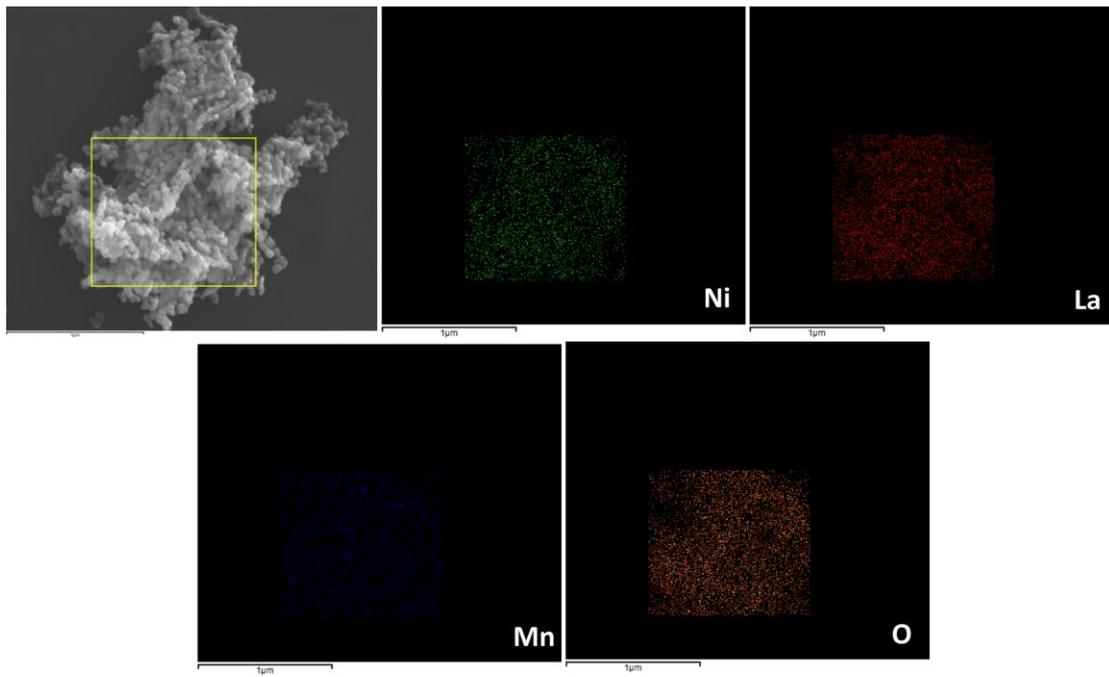**Eswaravara Prasadarao Komarala[1†], Ilia Komissarov[1†] and Brian A. Rosen[1*]**

1) Department of Materials Science and Engineering, Tel Aviv University, Ramat Aviv, 6997801, Israel.
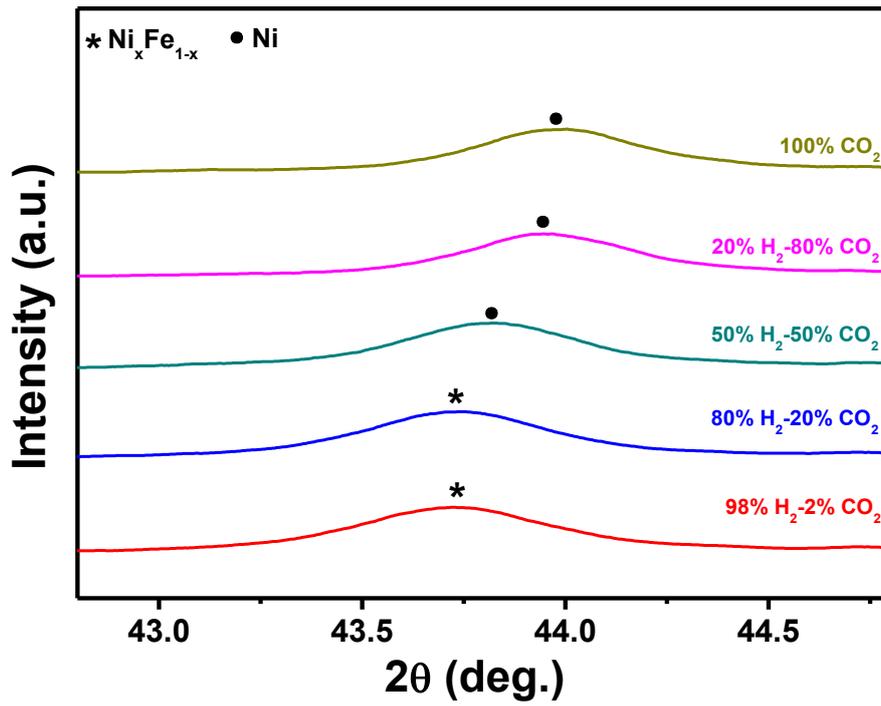†Authors with equal contribution

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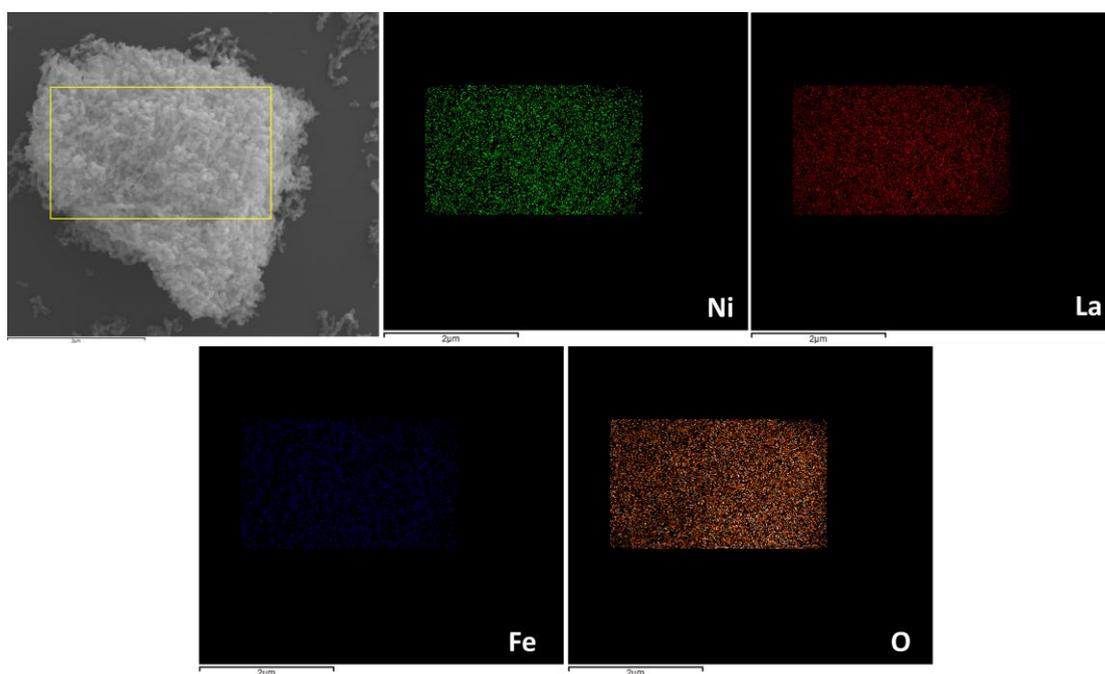
**Figure S1:** EDS mapping of as synthesized $LaNi_{0.8}Fe_{0.2}O_3$ perovskite.

Figure S2: EDS mapping of as synthesized LaNi$_{0.8}$Mn$_{0.2}$O$_3$ perovskite.

Figure S3: In-situ XRD of reduced $LaNi_{0.8}Fe_{0.2}O_3$ perovskite heated at 800°C in different ratios of H_2 and CO_2 atmospheres. The XRD shows that the de-alloying of Ni-Fe to pure Ni is more favorable in strong oxidizing atmosphere.
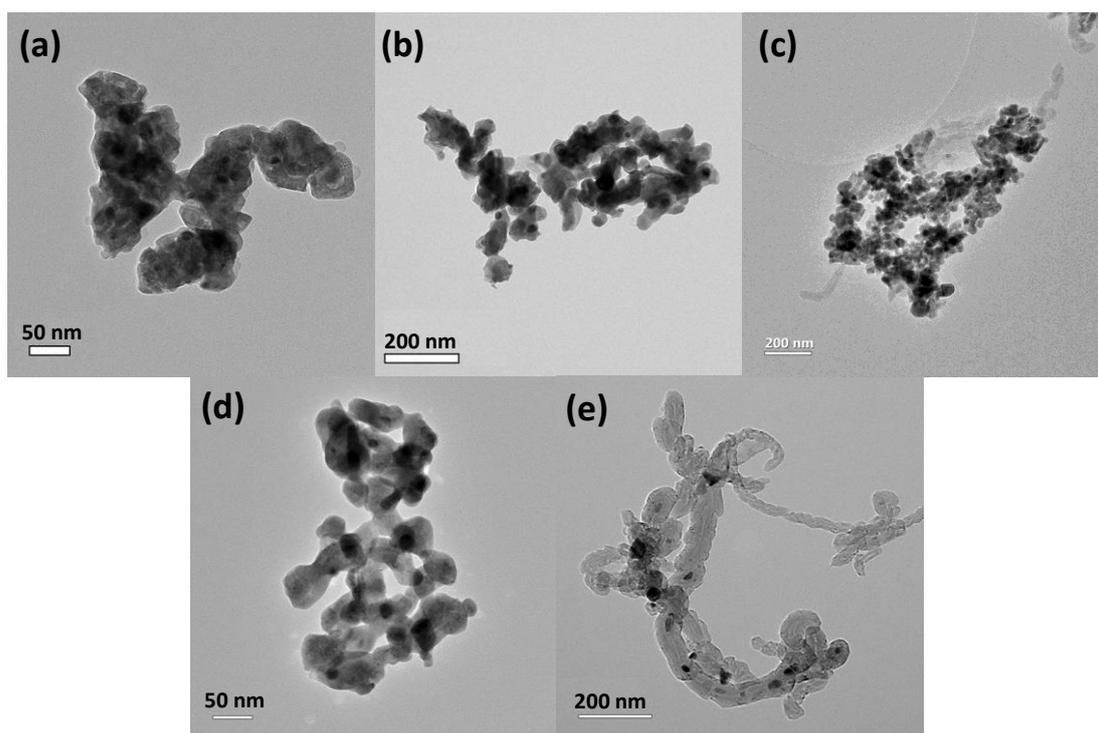
Figure S4: TEM images of $LaNi_{0.8}Fe_{0.2}O_3$ perovskite (a) reduced, after DRM at 800^0C for (b) 12 h and (c) 34 h; TEM images of $LaNi_{0.8}Mn_{0.2}O_3$ perovskite (d) reduced and (e) after DRM at $800\ ^0C$ for 34 h. Fe-substituted perovskite shows more resistant towards carbon accumulation than the Mn-substituted perovskite.
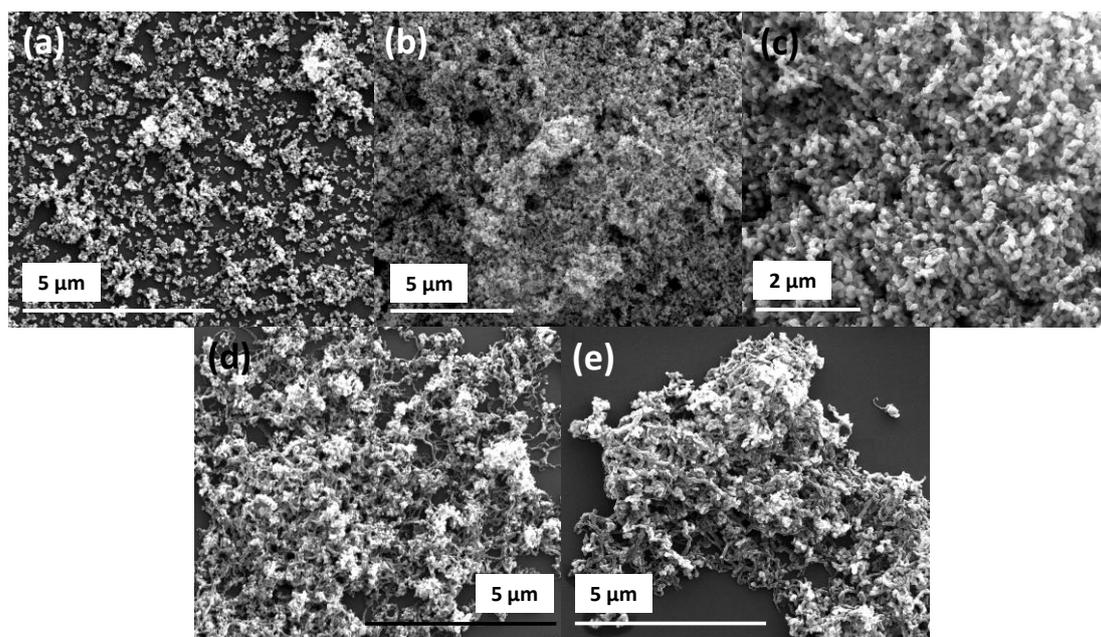
Figure S5: SEM images of LaNi$_{0.8}$Fe$_{0.2}$O$_3$ perovskite after DRM at (a) 650 °C, (b) 800 °C, 12h, and (c) 800 °C, 34h; SEM images of LaNi$_{0.8}$Mn$_{0.2}$O$_3$ perovskite after DRM at (d) 650 °C and (e) 800 °C.
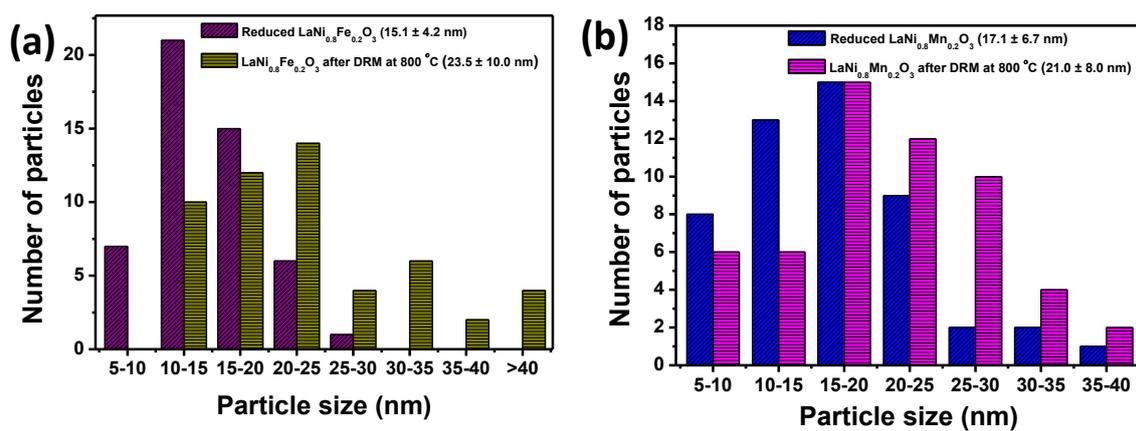
Figure S6: Particle size distribution of both the catalysts before and after dry reforming reaction at 800 °C for 34h: (a) $LaNi_{0.8}Fe_{0.2}O_3$ and (b) $LaNi_{0.8}Mn_{0.2}O_3$ catalysts. Average particle size with standard deviation is given in the graph.