

CaSi₂/Si 基板を用いて作製した Si 基ナノシート束**Si-based Nanosheet Bundle Synthesized using CaSi₂/Si Substrates**

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1. Introduction Since the discovery of graphene, free standing nanosheets have been intensively investigated, and semiconductor two-dimensional nanosheets have been synthesized as a new class of nanoscale materials. The formation of Si nanosheets by Ca extraction from CaSi₂ by electrochemical methods in solutions, and their structural modification were reported [1,2]. On the other hand, the formation of silicides and silicon nanostructures and their structural modification using metal chlorides have been intensively investigated, and it is expected to fabricate Si-based nanostructures using metal chlorides. In this paper, formation of Si-based nanosheets by extraction of Ca from CaSi₂ layers on Si substrates using CrCl₂ is reported.

2. Experimental procedure Nanosheets were synthesized by exposure of CaSi₂/Si substrates to CrCl₂ vapor evaporated at 872 °C at the substrate temperature of 650 °C for 10 min. The structural properties of the nanosheets were characterized by SEM and TEM with EDS.

3. Results and discussion Figure 1 shows SEM images of the substrate surface (a) before and (b) after the CrCl₂, and transformation of the structural surface morphology of the substrate to flake-like structures was observed after the CrCl₂ treatment. Figure 2 shows TEM images of the Si-based nanosheet in the flake-like structure. It is found that the flake-like structure consists of nanosheets, and the nanosheet has a stepped structure. It would be possible that Ca atoms are preferentially removed from the substrate to form Si-based nanostructures. It is found that metal chlorides are preferable to extract Ca atoms from CaSi₂ to form Si-based nanosheets. Further characterizations of the nanosheets will be expected.

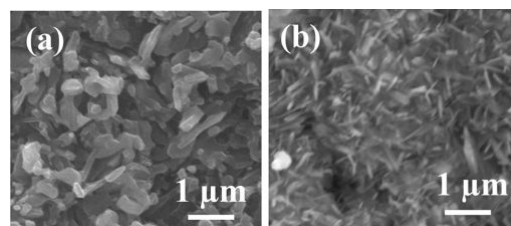


Fig.1 SEM images of the substrate surface (a) before and (b) after the CrCl₂ treatment.

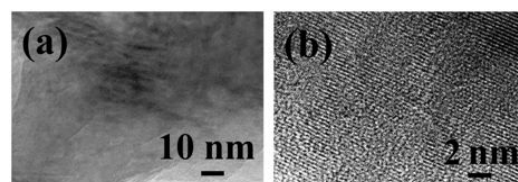


Fig.2 TEM images of the nanosheets with (a) low and (b) high magnifications. The lamellar structure and the stepped surface structure of the nanosheets are clearly observed.

- [1] H. Nakano, M. Ishii, H. Nakamura, Chem. Commun. 2005, 2945.
[2] H. Nakano, T. Mitsuoka, M. Harada, K. Horibuchi, H. Nozaki, N. Takahashi, T. Nonaka, Y. Seno, H. Nakamura, Angew. Chem., Int. Ed. **45** (2006) 6303.