# Single Phase High Entropy Intermetallics And Method For Manufacturing

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OTHER INFORMATION

CATEGORIZED AS

» **Materials & Chemicals**
» Thin Films

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2021-745-0

## BRIEF DESCRIPTION

A novel method to form single-phase high entropy silicide materials by multilayer metal deposition and controlled heat treatment on silicon substrates.

## FULL DESCRIPTION

This technology involves depositing at least two metal layers—such as Cr, Mo, Ta, Nb, and V—onto a silicon substrate to create a thin, multilayer film, followed by heat treatment that promotes interdiffusion between the metals and silicon. This process forms single-phase high entropy silicide materials, including ternary (CrMoTa)Si2 and quinary (CrMoTaVNb)Si2 compositions, characterized by a C40 hexagonal crystal structure. The candidate compositions are identified using the CALPHAD approach and experimentally synthesized by electron beam evaporation followed by vacuum heat treatment.

## SUGGESTED USES

- Advanced semiconductor and microelectronic device fabrication
- Protective and wear-resistant coatings in aerospace and automotive industries
- High-temperature structural materials for energy and industrial applications
- Development of novel thin film materials for sensors and MEMS devices
- Materials research and development for next-generation electronics

## ADVANTAGES

- Enables formation of single-phase high entropy silicides with controlled composition
- Utilizes electron beam evaporation for precise, sequential metal layer deposition
- Employs CALPHAD modeling to identify optimal silicide compositions
- Produces silicides with enhanced structural stability and hexagonal crystal phase
- Flexible processing allowing sequential or concurrent deposition and heat treatment

## PATENT STATUS

| Country | Type | Number | Dated | Case |
|---|---|---|---|---|
| United States Of America | Published Application | 20230407460 | 12/21/2023 | 2021-745 |

## RELATED MATERIALS


- Vyatskikh, A. L., MacDonald, B. E., Dupuy, A. D., Lavernia, E. J., Schoenung, J. M., & Hahn, H. (2021). High entropy silicides: CALPHAD-guided prediction and thin film fabrication. Scripta Materialia, 201, 113914.



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