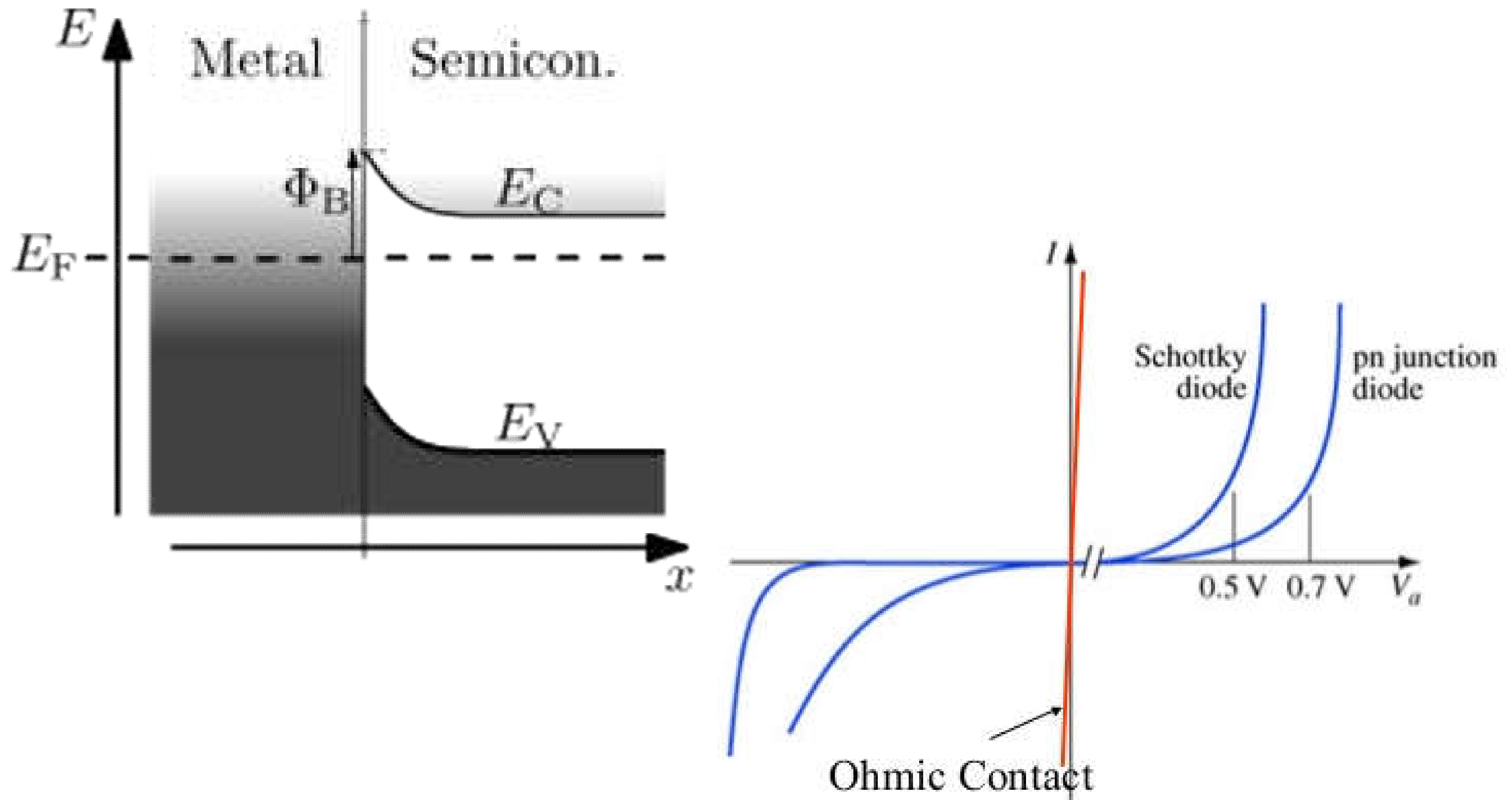
*Principles of Micro- and Nanofabrication for Electronic and Photonic Devices*

# Film Deposition
# Part III: Silicide

**Xing Sheng 盛兴**

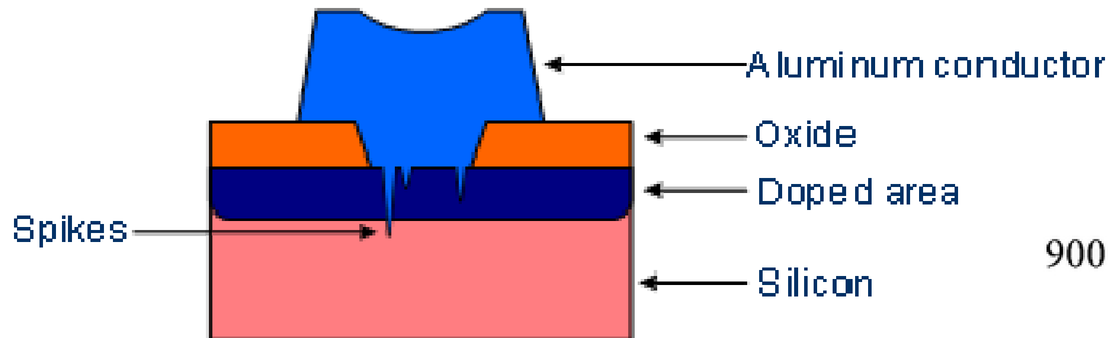
**Department of Electronic Engineering**
**Tsinghua University**
**xingsheng@tsinghua.edu.cn**

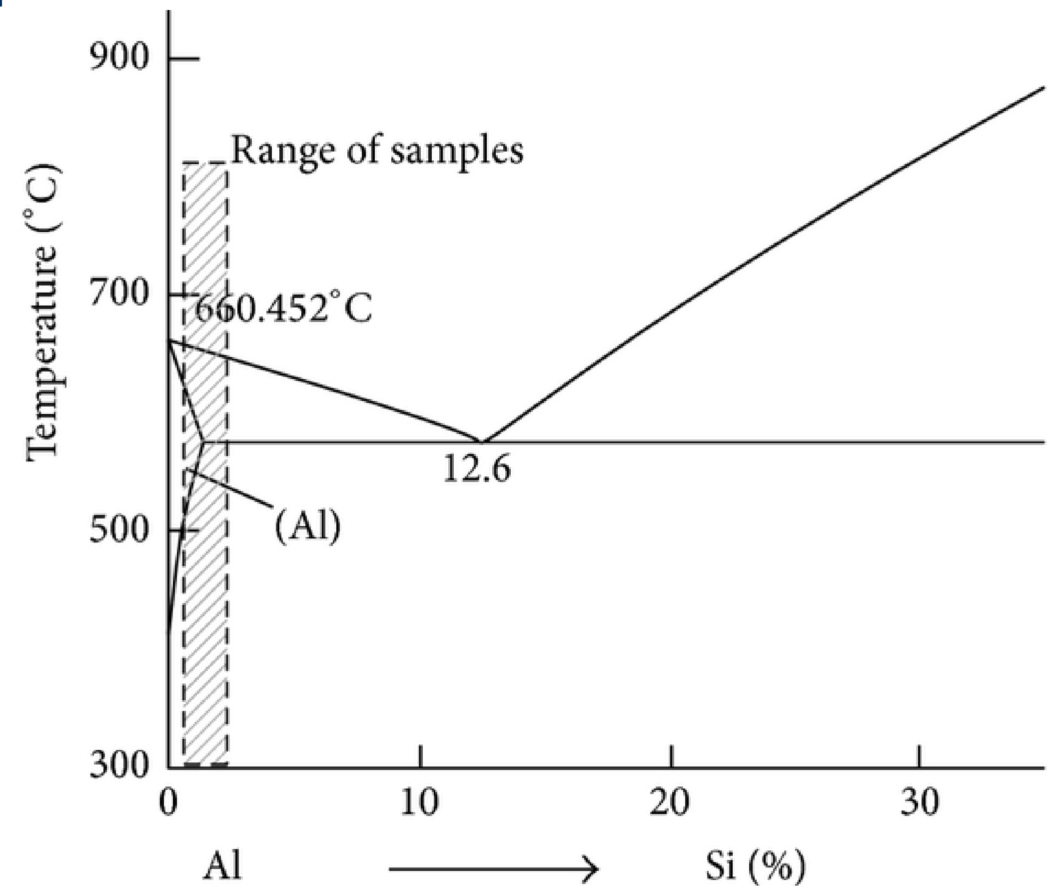
# Metals on Silicon: Issues




**forming Schottky contacts**

# Metals on Silicon: Issues

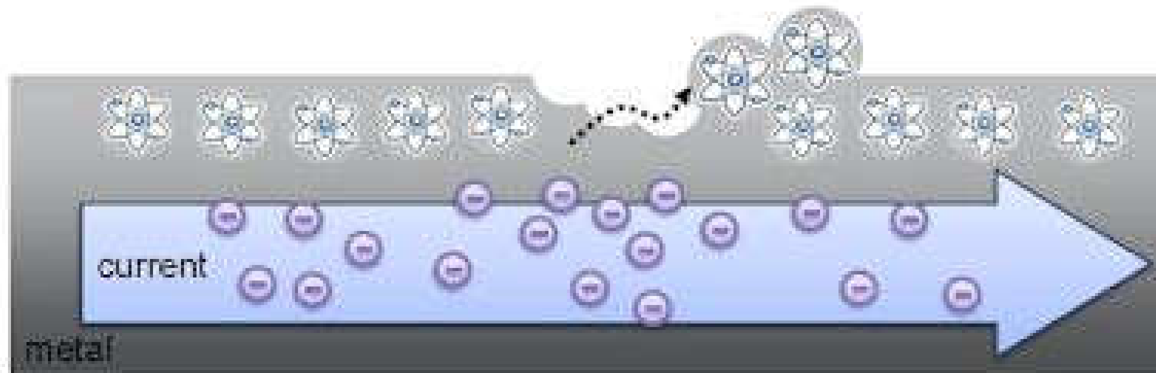


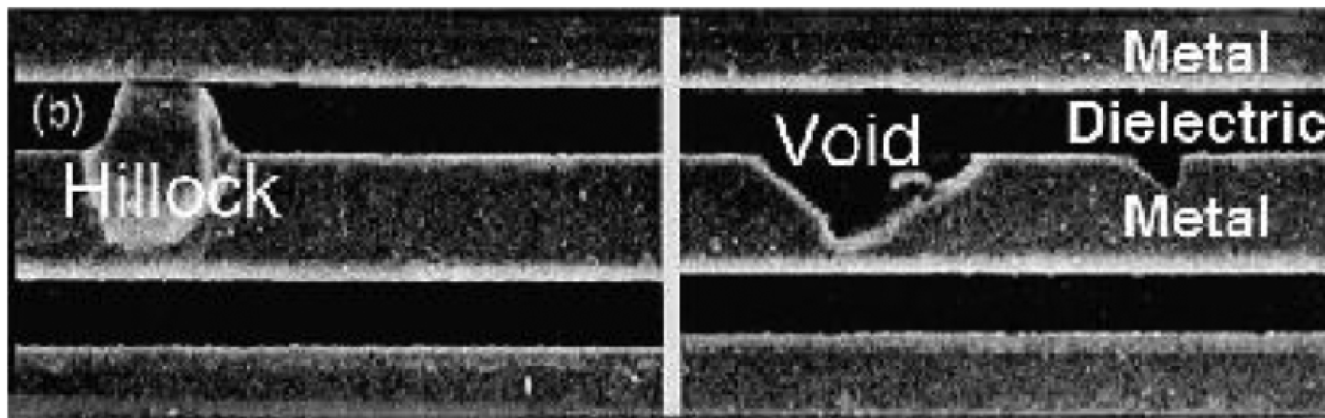

**Metal diffuses into Si: 'spiking'**

# Metals on Silicon: Issues

## metal flow under high current



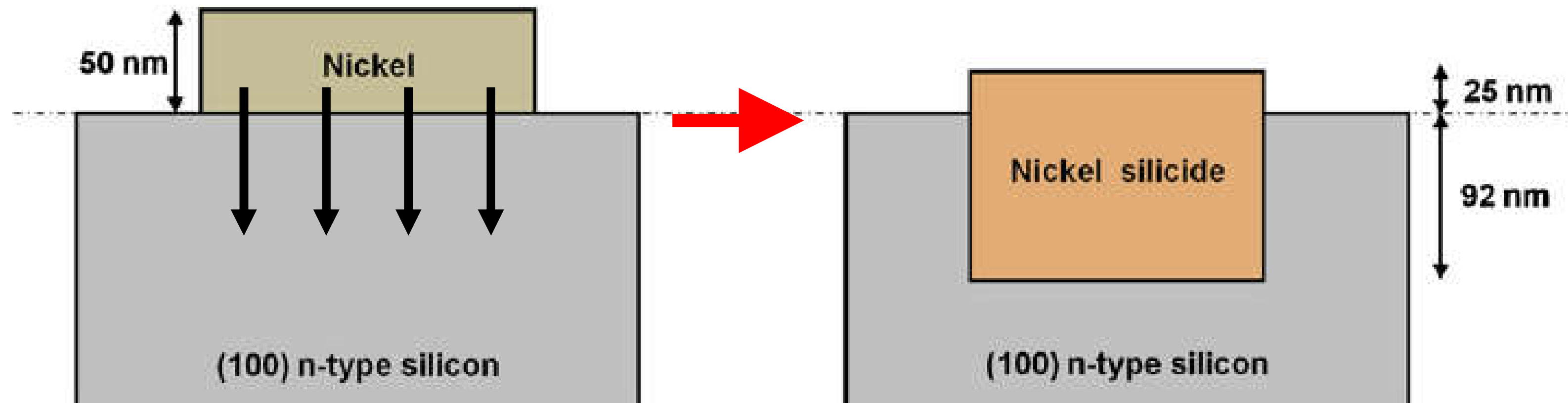

Video

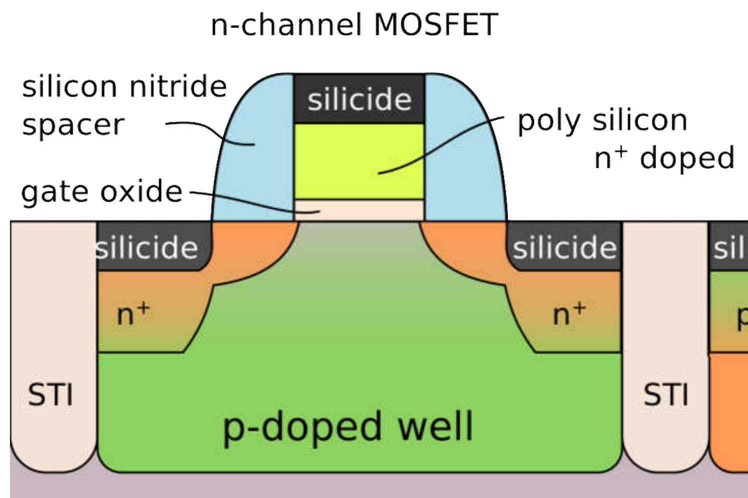



'electromigration' (电迁移)

# Silicide Formation

## Metal diffuses into Si

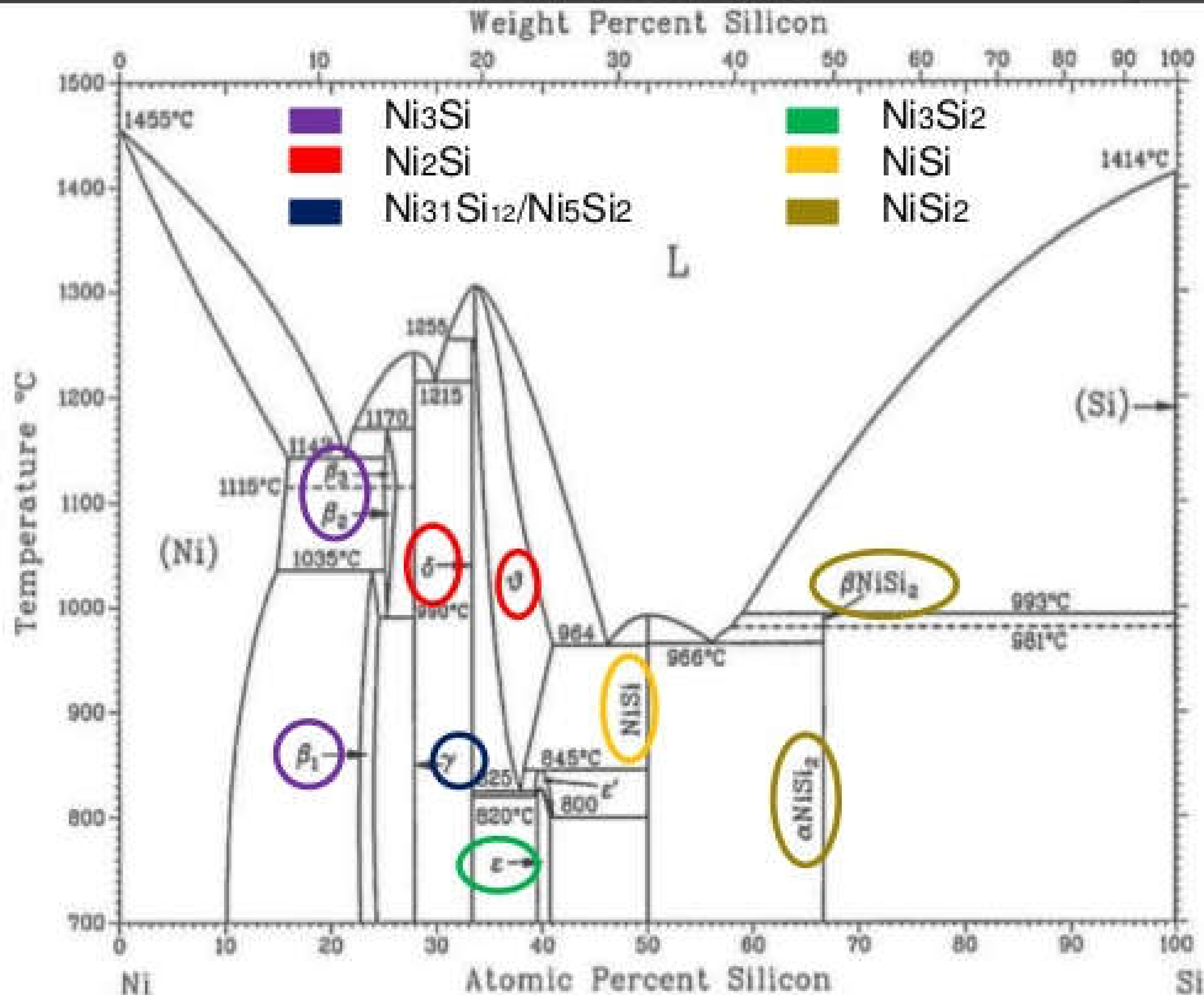



## Silicide for contact:

- ohmic contact
- thermally stable
- diffusion barrier
- reduce electromigration

# Silicide Formation




**intermetallic phases**

# Silicide Formation

TABLE 7.2 Properties of Some Silicides of Interest. Reprinted with permission of the American Institute of Physics from Ref [4].

| Silicide | Starting Form | Sintering Temperature (°C) | Lowest Binary Eutectic Temperature (°C) | Specific Resistivity (μohm-cm) |
|---|---|---|---|---|
| $CoSi_2$ | Metal on polysilicon | 900 | 1195 | 18–25 |
| | Cosputtered alloy | 900 | | |
| $HfSi_2$ | Metal on polysilicon | 900 | 1300 | 45–50 |
| $MoSi_2$ | Cosputtered alloy | 1000 | 1410 | 100 |
| $NiSi_2$ | Metal on polysilicon | 900 | 966 | 50 |
| | Cosputtered alloy | 900 | | 50–60 |
| $Pd_2Si$ | Metal on polysilicon | 400 | 720 | 30–50 |
| PtSi | Metal on polysilicon | 600–800 | 830 | 28–35 |
| $TaSi_2$ | Metal on polysilicon | 1000 | 1385 | 35–45 |
| | Cosputtered alloy | 1000 | | 50–55 |
| $TiSi_2$ | Metal on polysilicon | 900 | 1330 | 13–16 |
| | Cosputtered alloy | 900 | | 25 |
| $WSi_2$ | Cosputtered alloy | 1000 | 1440 | 70 |
| $ZrSi_2$ | Metal on polysilicon | 900 | 1355 | 35–40 |