**Specific Information of Heat Treatments**

In pearlite, austenitization occurred by low Mn concentration: Is it possible for austenite to be enriched with enough Mn? Motivation

Austenite did not grow by only consuming cementite.

### The Purpose of the Heat Treatments

- **Alloy 2**

#### Flow Chart

1. **First Anneal**
   - 200, 400, 800 ℃
   - Significantly, each heat treatment showed...

2. **Second Anneal**
   - 30-45 wt% Mn
   - 
   - 

3. **Third Anneal**
   - 5min
   - 
   - 

#### Conclusion

- Cementite Formation & Mn Enrichment in Cementite

### Cementite Formation

- ②

### Results & Discussion

#### Table: Cementite Volume Percent

- **Alloy Composition**
  - **Design**
  - **First Anneal**
    - 595, 727, 954
    - wt% austenite
  - **Second Anneal**
    - 600-700, 750
    - wt% austenite
  - **Third Anneal**
    - 670, 800
    - wt% austenite

#### Microanalysis using EDS

- **After the First Anneal**
  - **Alloy 1**
    - 4.92 wt% C & 5 wt% Mn
    - Mass percent of cementite / %
      - 0.3
      - 0.621
    - Al / wt%
      - 0.250
    - Mn / wt%
      - 30.2 ± 8.6 (S)
    - S / wt%
      - 7.3 ± 2.6

- **Alloy 2**
  - 7.3 ± 2.6
  - 0.650
  - 25.1 ± 8.0 (P)
  - 23.4 ± 7.4 (P)

- **Alloy 3**
  - 5, 7 wt% Mn
  - 0.027
  - 0.650
  - 23.4 ± 7.4 (P)
  - 26.9 ± 8.6 (P)

#### Box Furnace

- Computational Metallurgy Lab, Graduate Institute of Ferrous Technology, POSTECH

#### EDS Results

- **After the Second Anneal**
  - 4.9 wt% C & 5 wt% Mn
  - Mass percent of cementite / %
    - γ
    - 0.7 wt%
      - 0.0053
    - θ
      - 0.0027

- **After the Third Anneal**
  - 5, 10 Vol.% cementite
  - Mass percent of cementite / %
    - γ
      - 0.7 wt%
      - 0.0053
    - θ
      - 0.0027

### Computational Metallurgy

- Reactive austenite forms ferrite and pearlite.
- Cementite gets enriched with Mn.
- 800 h!!
- 100-400 nm considered