



コンバージミルによる Fe-6.5wt%Si薄帯片追加粉碎 報告書

管理番号 : KA25008

報告日 : 2025年12月25日

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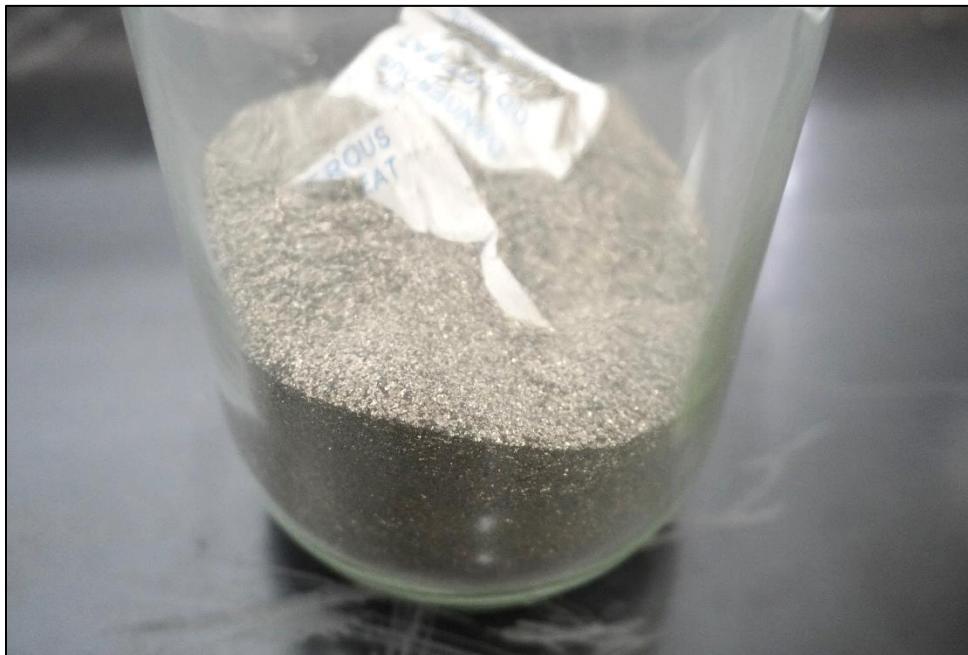


コンバージミルによるFe-6.5wt%Si薄帯片の追加粉碎の概要

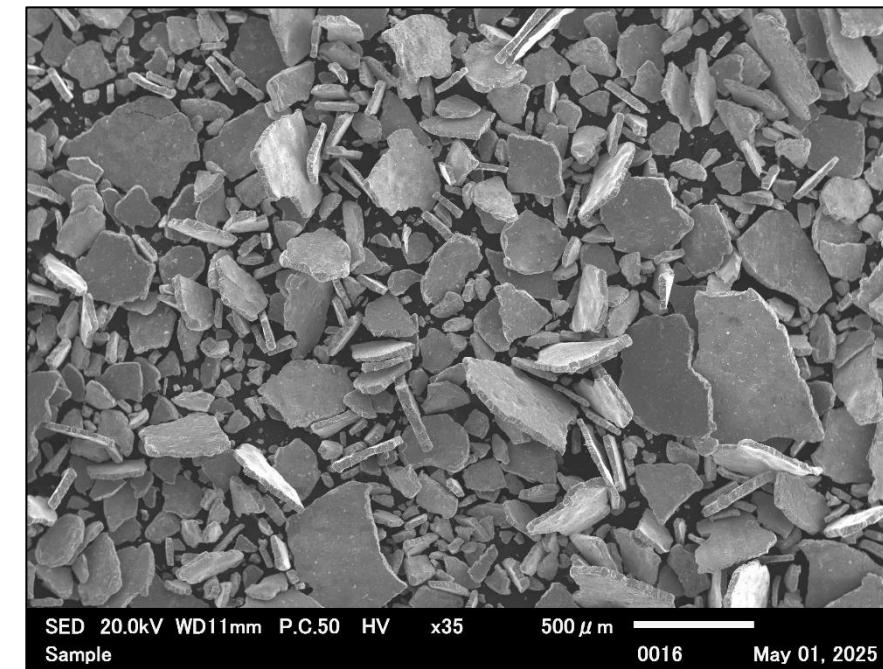
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液体急冷プロセスにより作製したFe-6.5%Si薄帯のスリット加工後の切れ端を一次粉碎したものについて、弊社コンバージミルにて追加粉碎を行い、粒径30 μm 前後の粉末を作製することができるかの確認を行いました。

Fe-6.5wt%Si薄帯一次粉碎試料



Fe-6.5wt%Si薄帯一次粉碎試料SEM画像



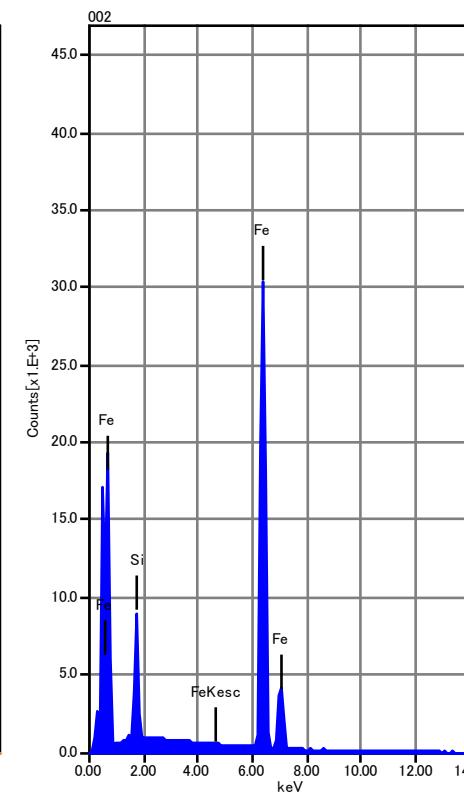
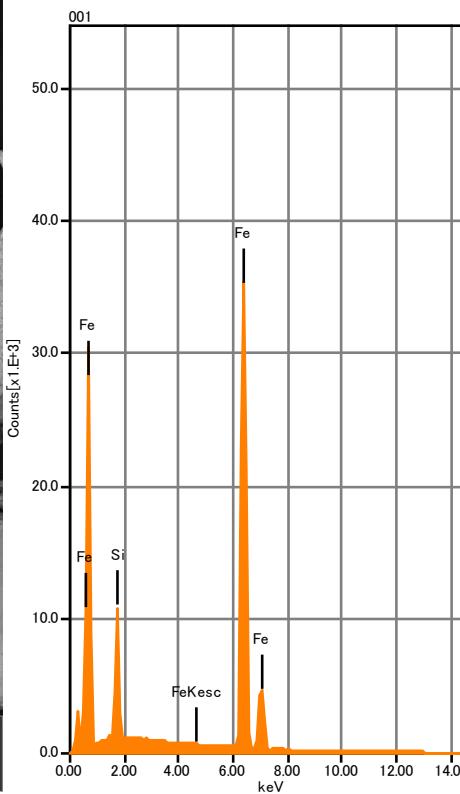
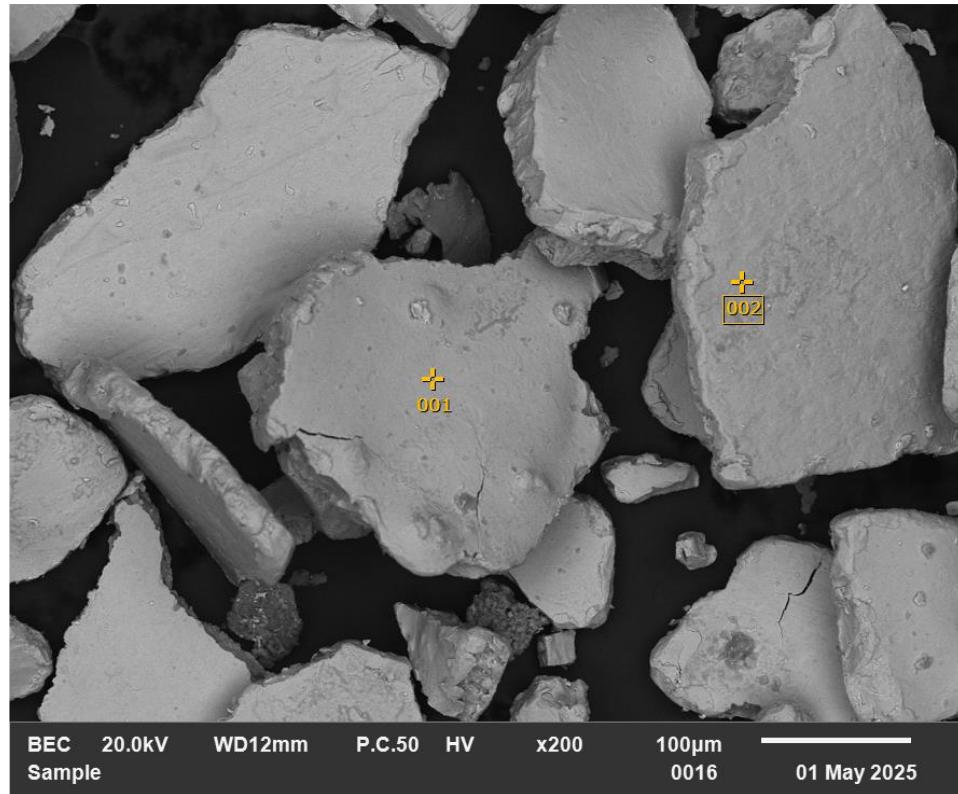
コンバージミル1ℓ機





Fe-6.5wt%Si薄帶一次粉碎試料 SEM-EDS

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測定条件

装置 : IT100LA
加速電圧 : 20.00 kV
照射電流 : ---
プロセスタイム : T4
ライブタイム : 900.00 秒
リアルタイム : 936.39 秒
デッドタイム : 5.00 %
カウントレート : 1738.00 CPS

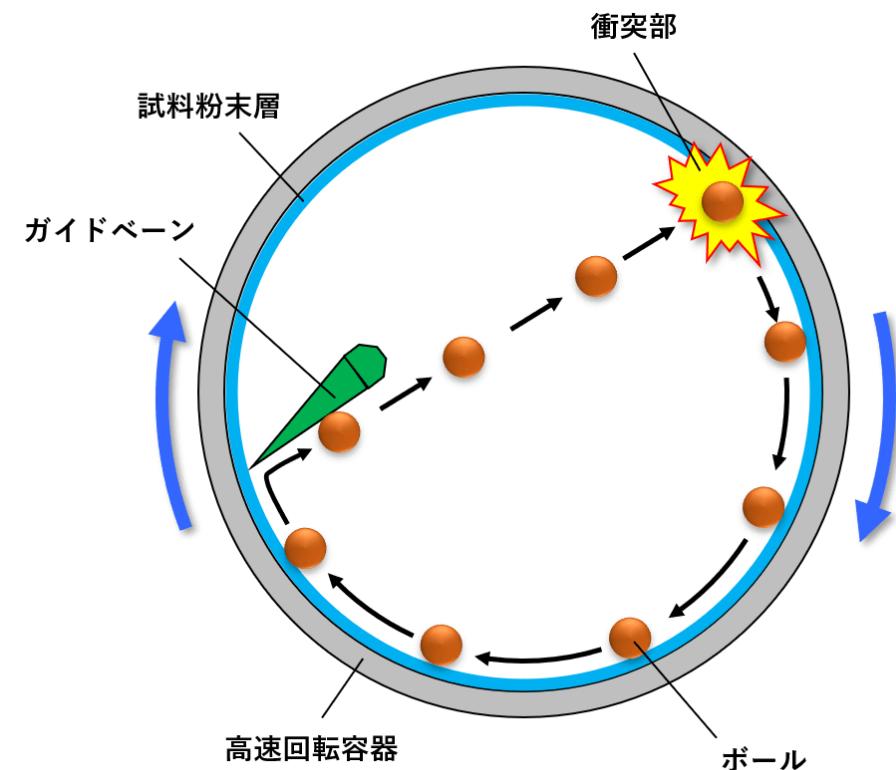
加速電圧 : 20.00 kV
倍率 : x 200
測定日時 : 2025/05/01
画素数 : 1280 x 960

	Si	Fe
001	7.09	92.91
002	6.86	93.14
平均	6.98	93.02
標準偏差	0.16	0.16



回転する容器に投入された媒体ボールと試料がガイドベーンによって方向を変えられ、反対側の壁に向かって飛び出します。そのボールが壁面にあるガイドベーンと容器のクリアランスより形成される粉体層に一転集中的にぶつかり、コンタミレスな微粉末試料を作製することができます。

詳細HP：<https://makabe-g.co.jp/products/converging-mill/>





回転数：240rpm SEM観察画像

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入手時

処理時間 = 1.0 h

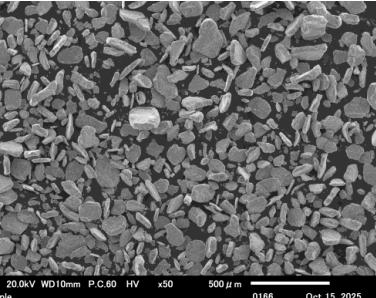
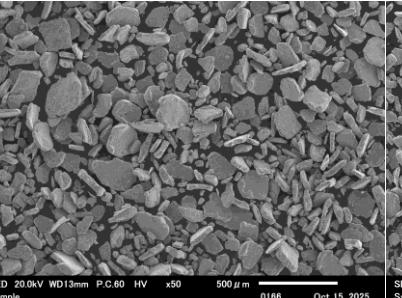
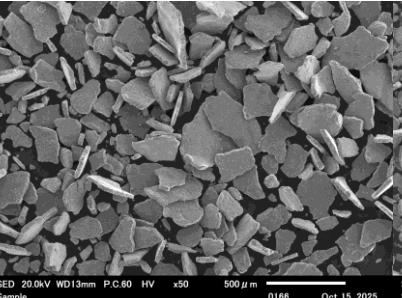
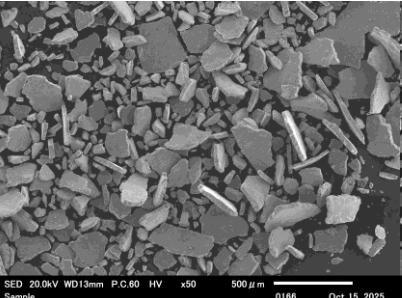
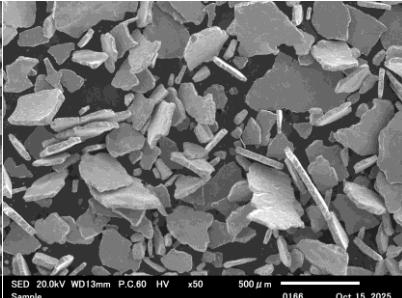
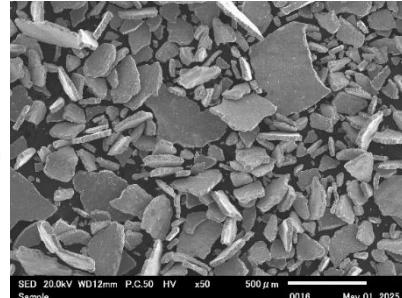
処理時間 = 2.0 h

処理時間 = 4.0 h

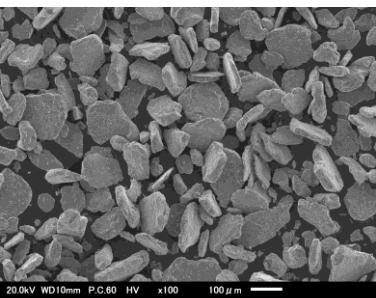
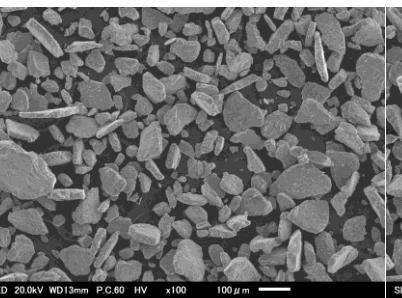
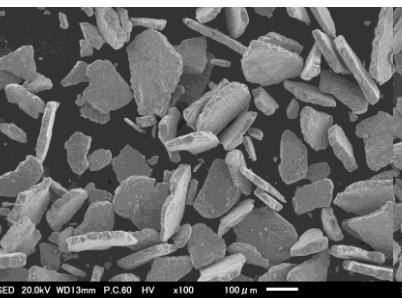
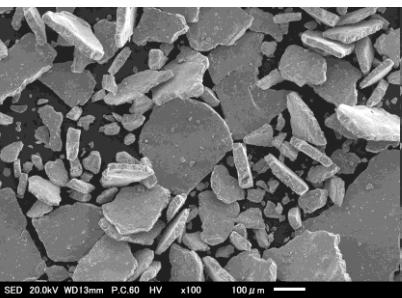
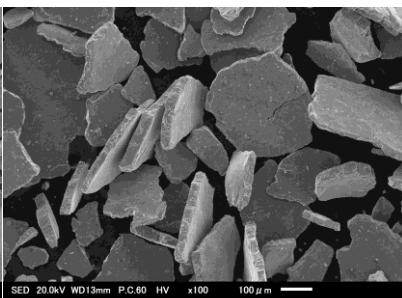
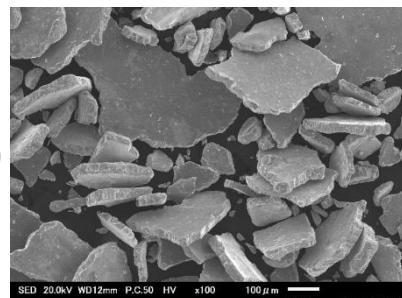
処理時間 = 8.0 h

処理時間 = 12.0 h

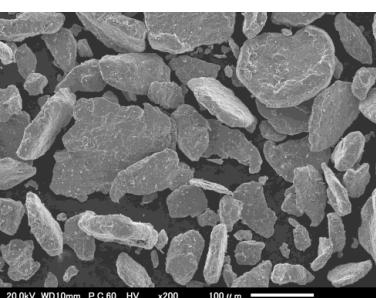
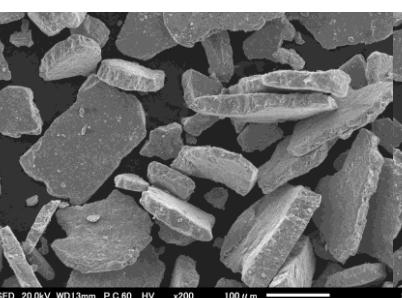
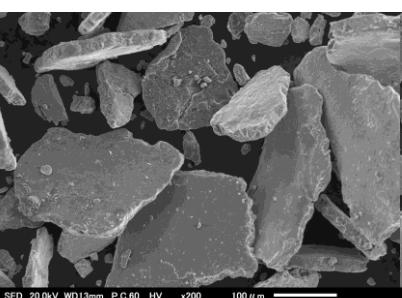
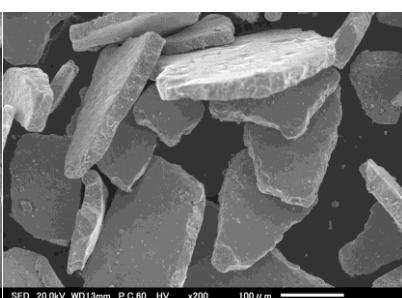
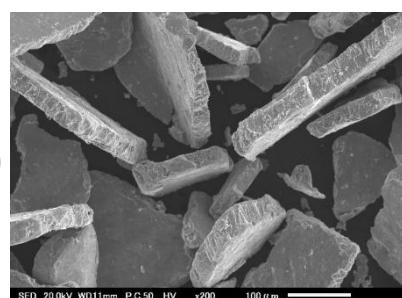
×50



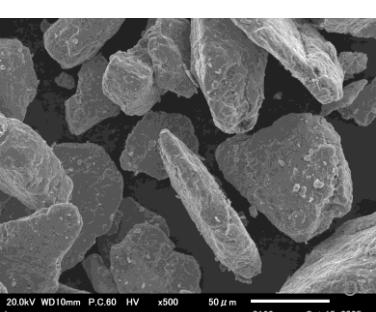
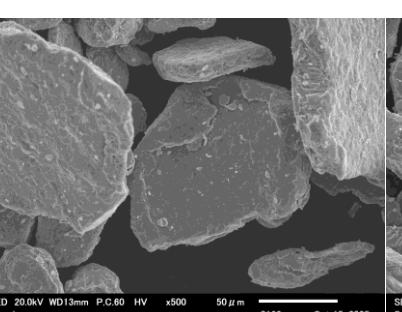
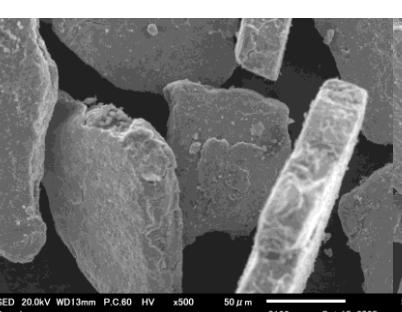
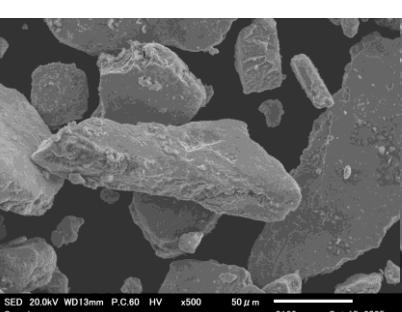
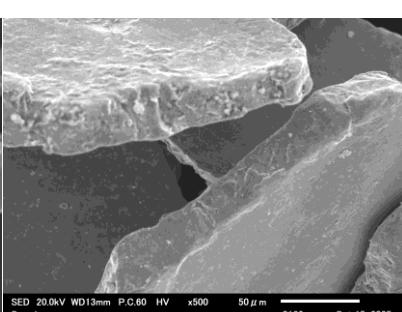
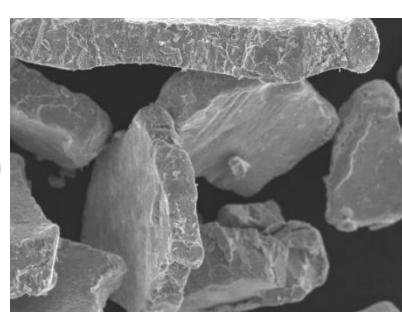
×100



×200



×500





回転数：360rpm SEM観察画像

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入手時

処理時間 = 1.0 h

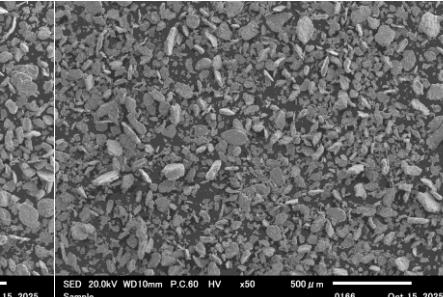
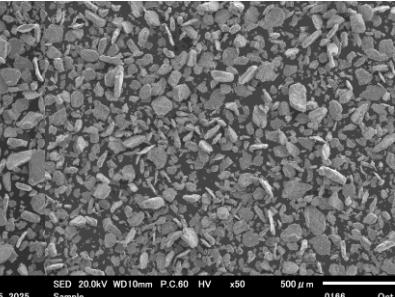
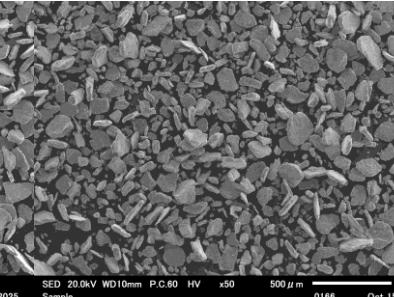
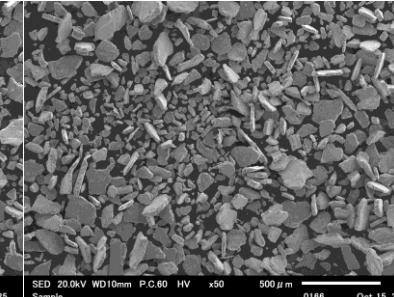
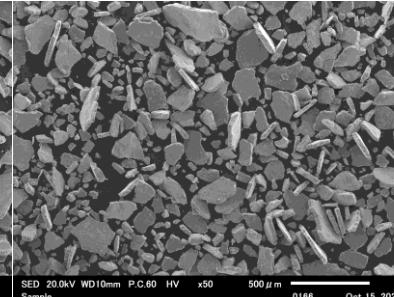
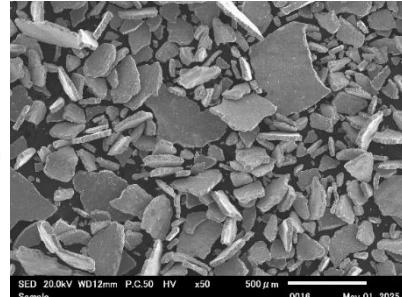
処理時間 = 2.0 h

処理時間 = 4.0 h

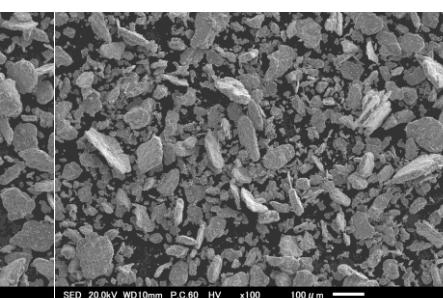
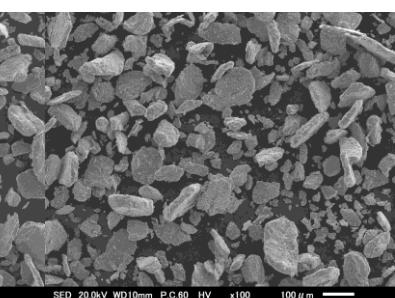
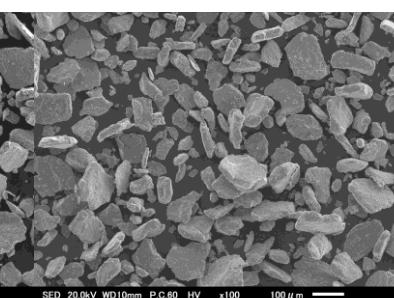
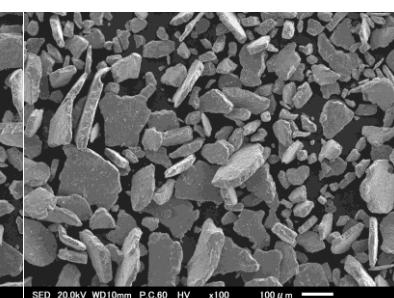
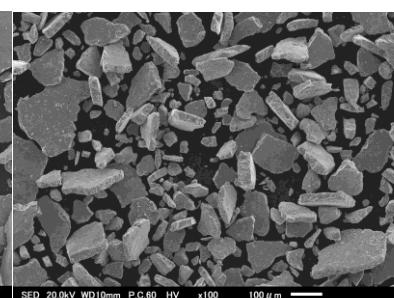
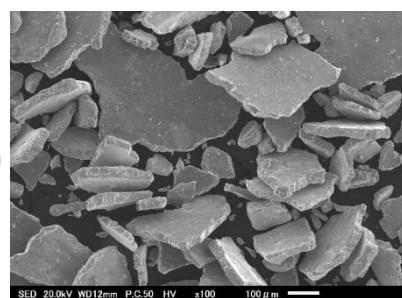
処理時間 = 8.0 h

処理時間 = 12.0 h

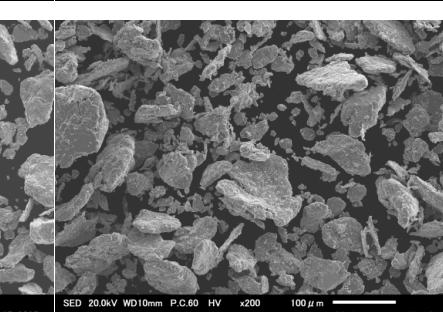
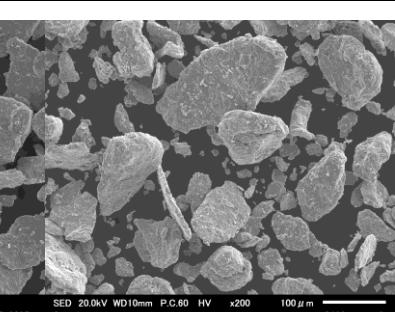
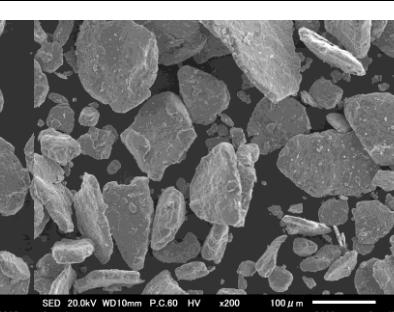
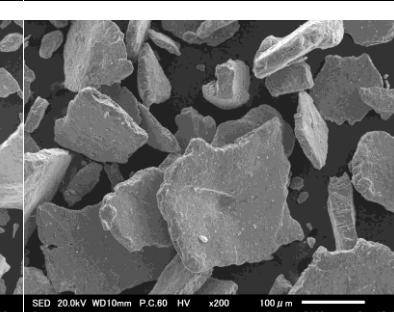
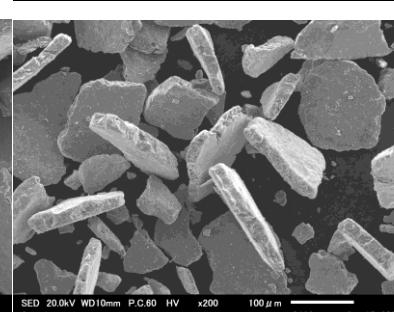
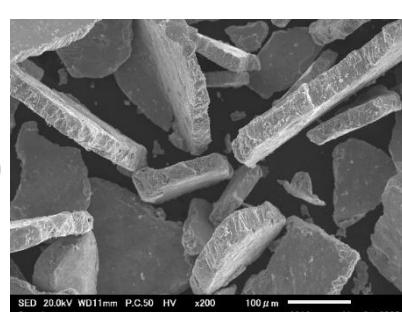
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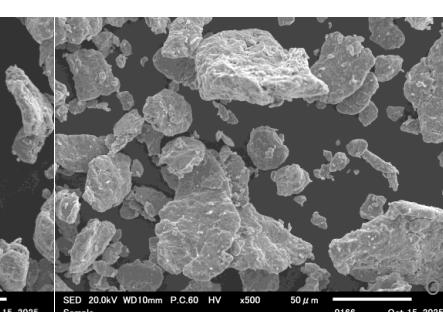
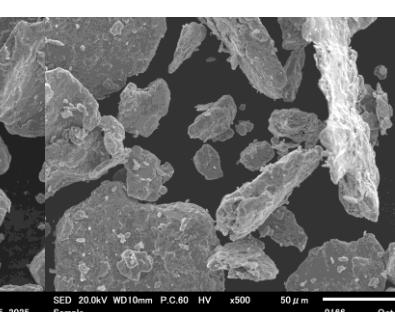
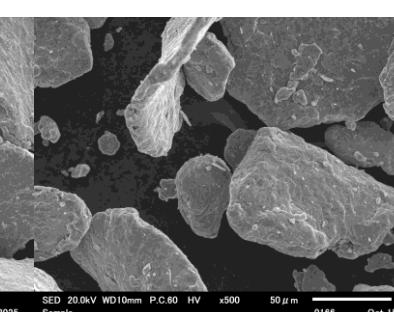
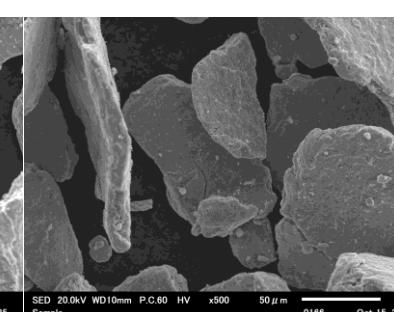
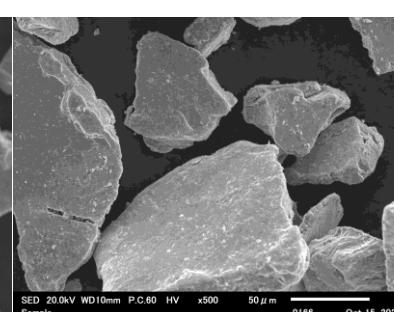
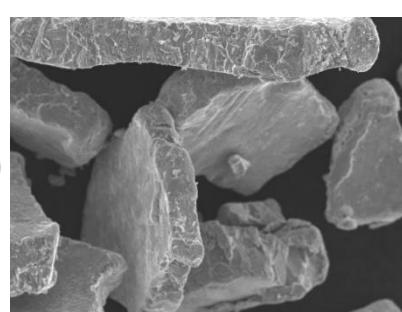
×100



×200



×500





回転数：480rpm SEM観察画像

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入手時

処理時間 = 1.0 h

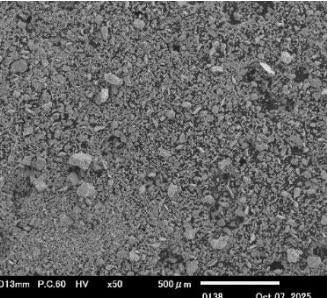
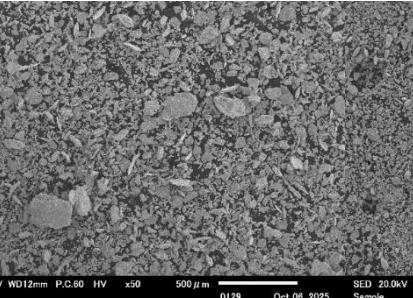
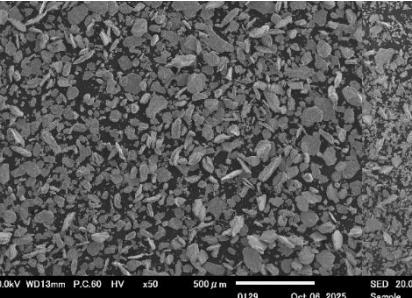
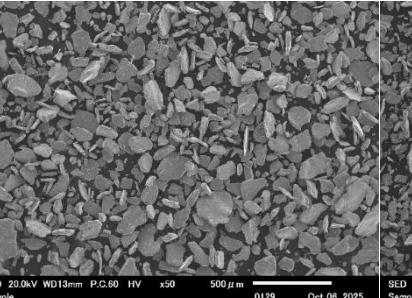
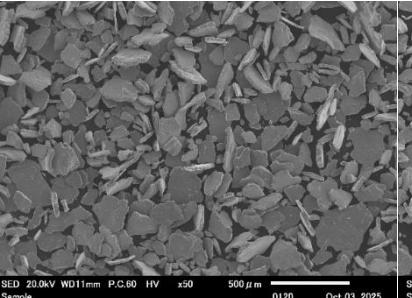
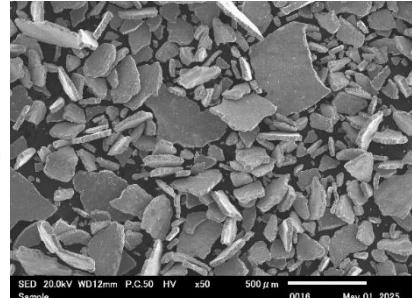
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処理時間 = 4.0 h

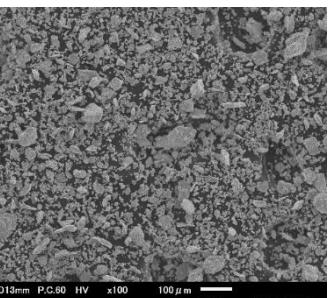
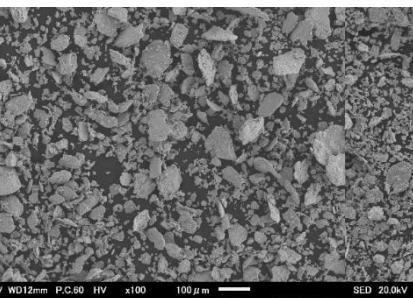
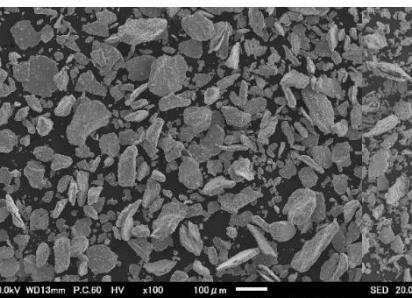
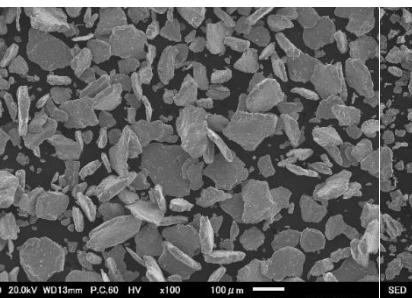
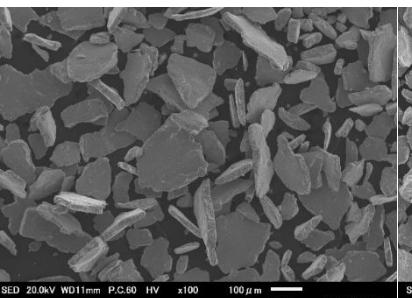
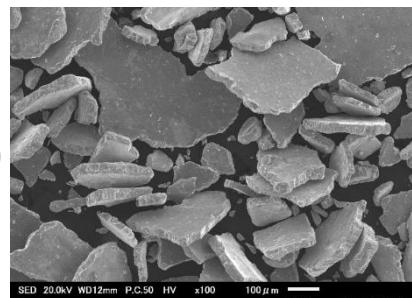
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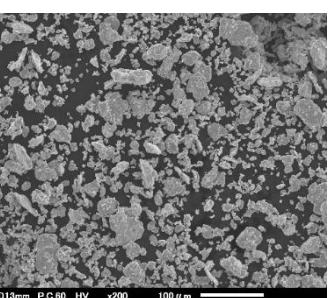
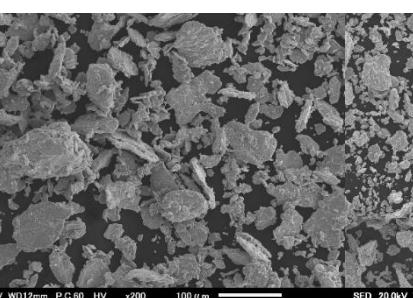
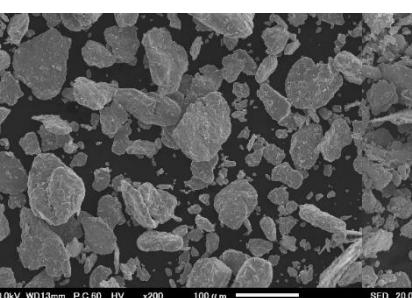
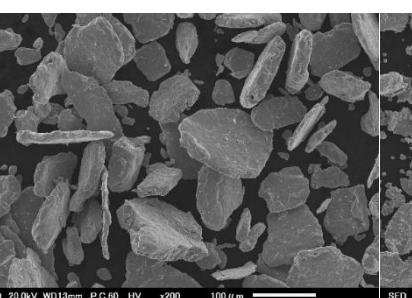
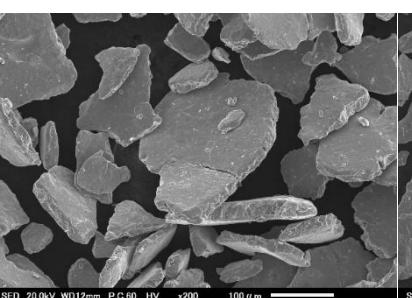
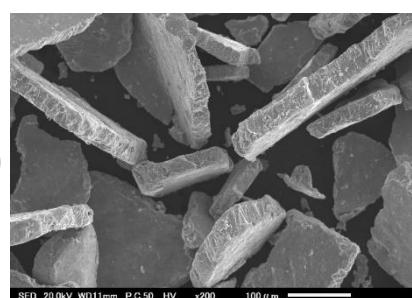
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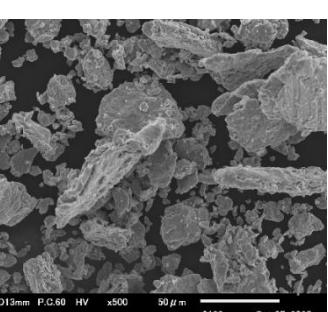
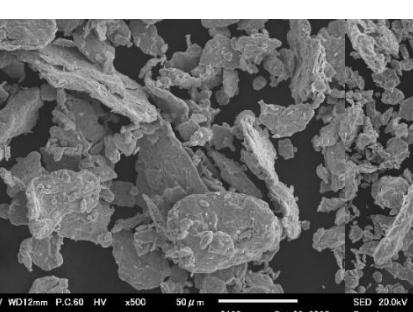
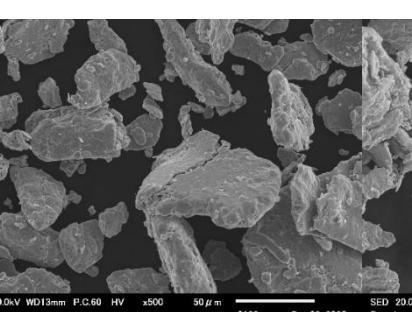
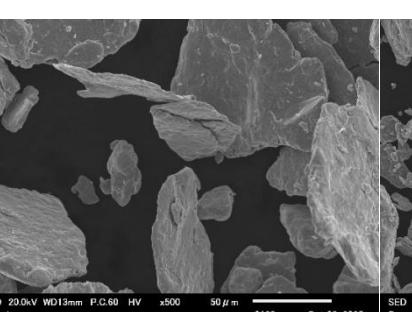
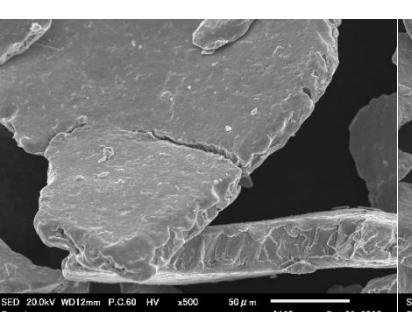
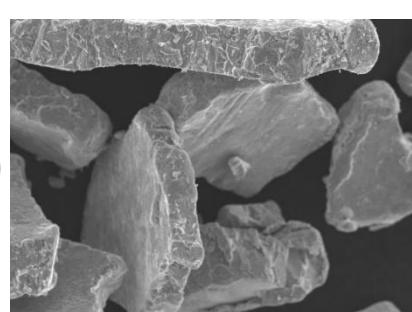
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×200



×500

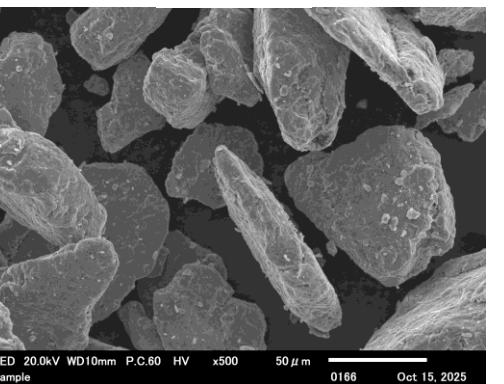
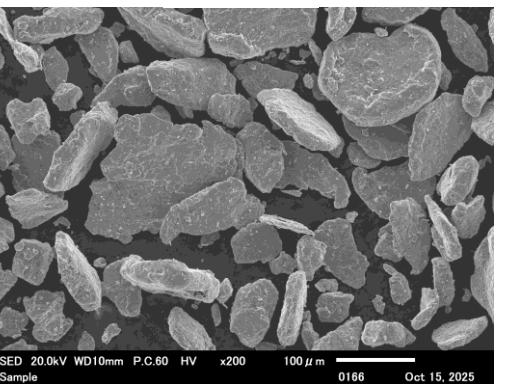
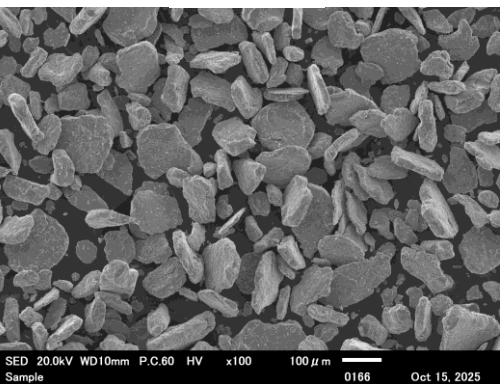
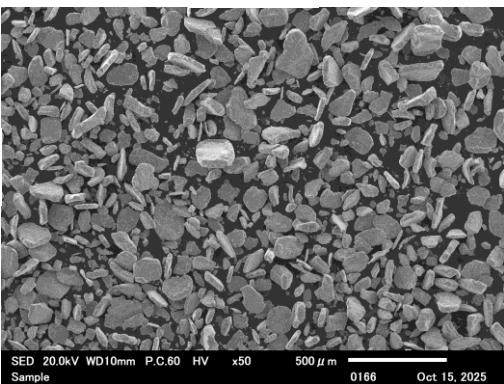




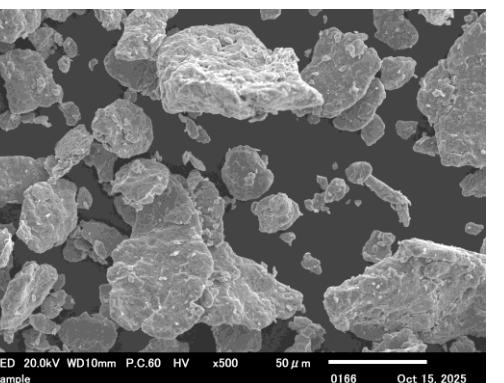
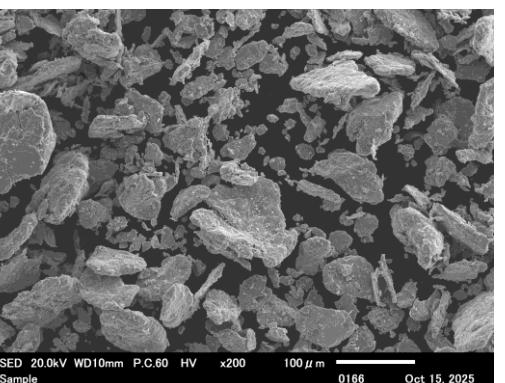
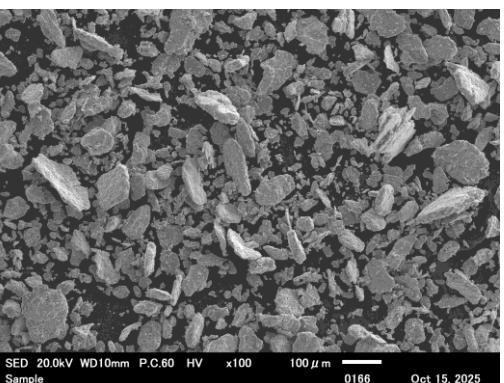
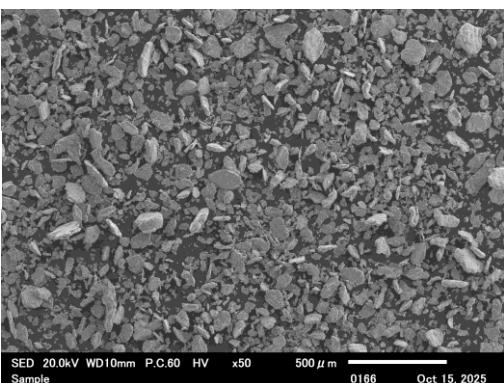
處理時間12.0h時SEM画像比較

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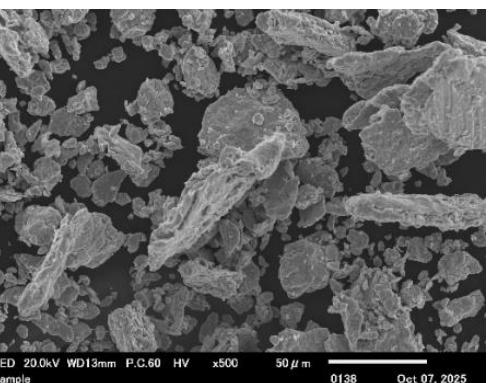
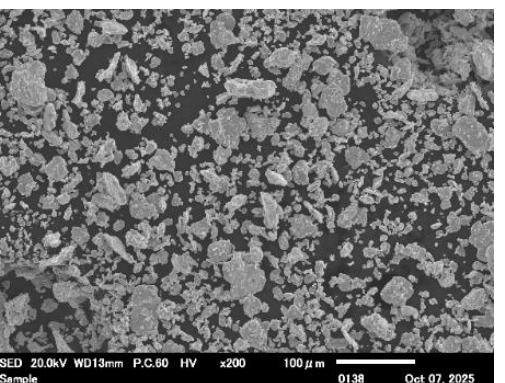
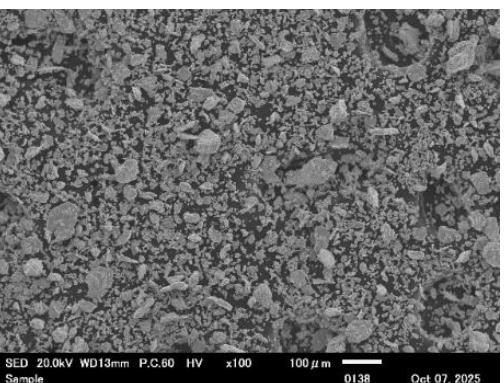
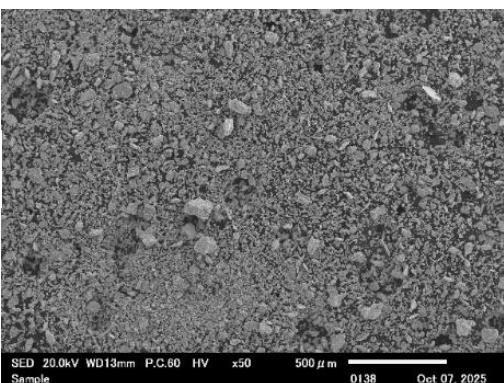
240rpm

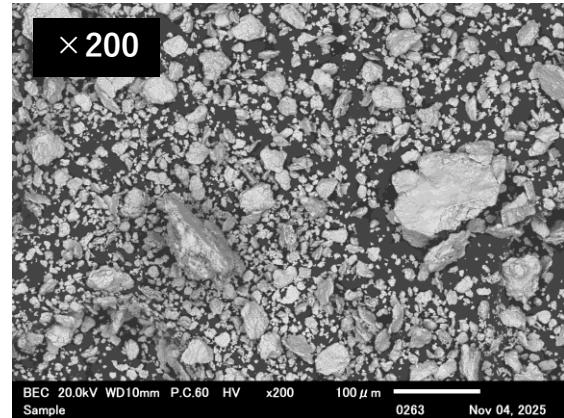


360rpm

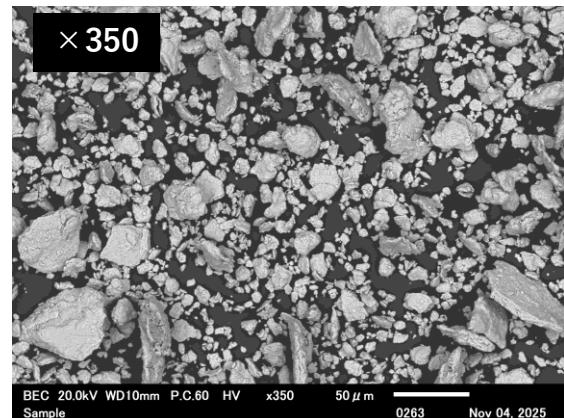


480rpm

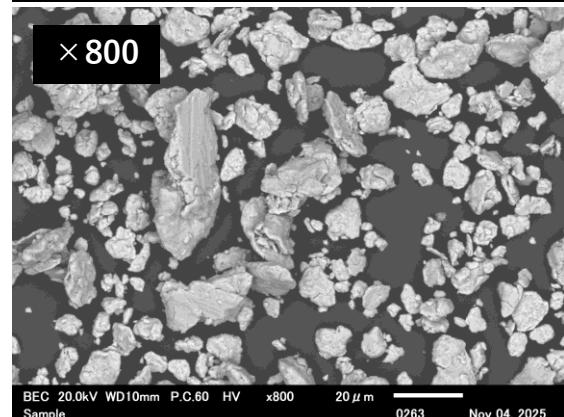




N = 48,428

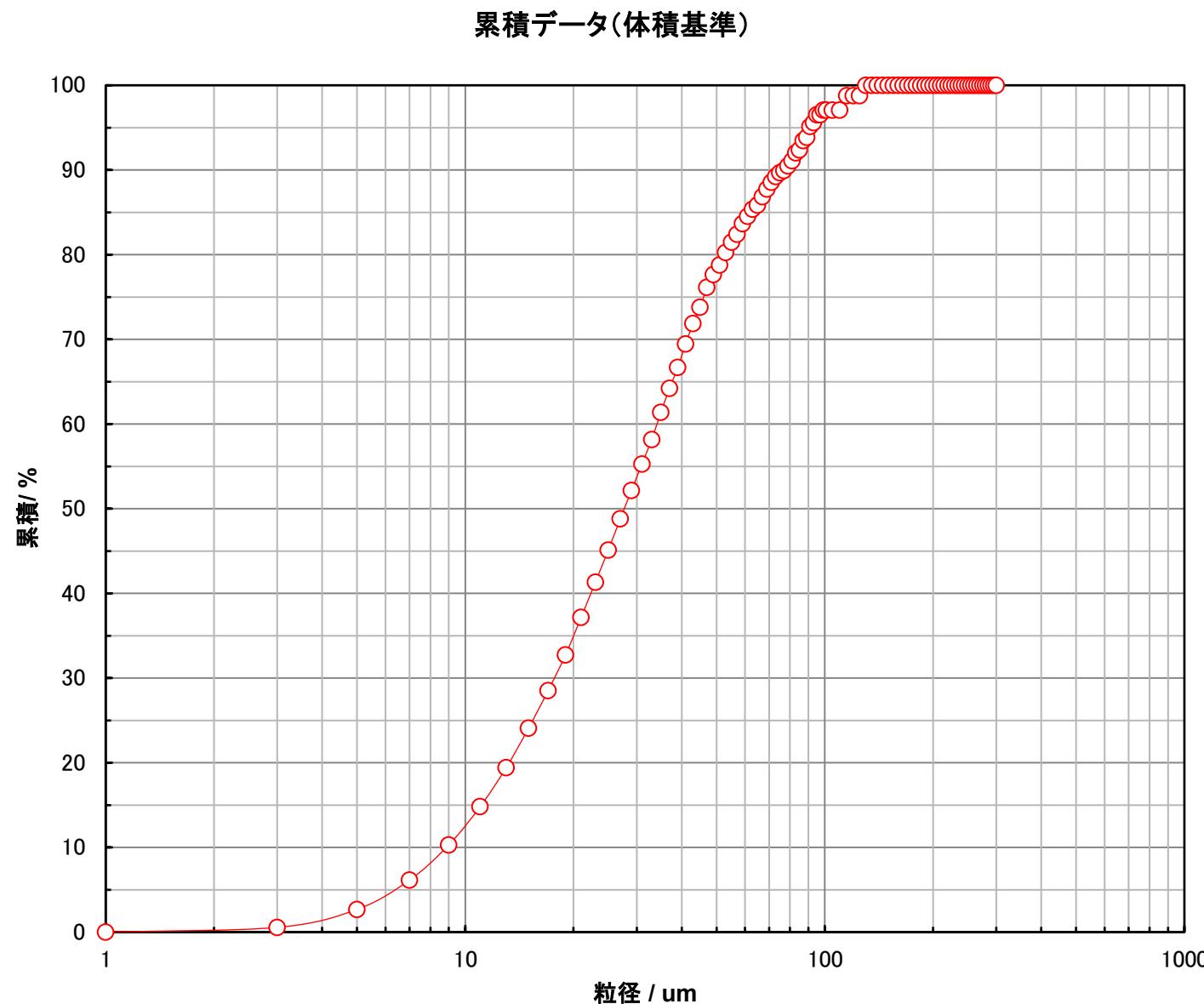


N = 51,895



N = 14,306

合計 N = 114,629





コンバージミルによるFe-6.5wt%Si薄帯片の追加粉碎試験まとめ

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- 薄帯は比較的割れやすく、分散材を使用しなくても一定の粉碎処理を行うことができました。ただ、480rpmでは8.0h付近から凝集物が見られ始めます。これを防ぐことを考える場合、分散材の添加が必要になると思われます。
- 回転数に応じて同一処理時間での粒径が小さくなる様子がSEMにより観察できました。
- 処理条件480rpm-12.0hの粒径はSEMによる粒度解析で約 $28\mu\text{m}$ となりました。
- 粉末の様子からボールが当たった部分で曲がり、折れるようにして破断したと考えられます。更に粒径が小さくなると凝集と再粉碎が繰り返されているものと思われます。分散材の投入で粒径の微細化と凝集予防になる可能性があります。
- 粉末が扁平形状となっており、圧粉磁心に使用した際の充填率増加とそれに伴う磁気特性の向上(透磁率向上、渦電流損失低下)、圧粉磁心の高周波領域への適用が期待できます。



480rpm-12.0h処理後状況

