

## APPENDIX F

## Scanning electron microscopy

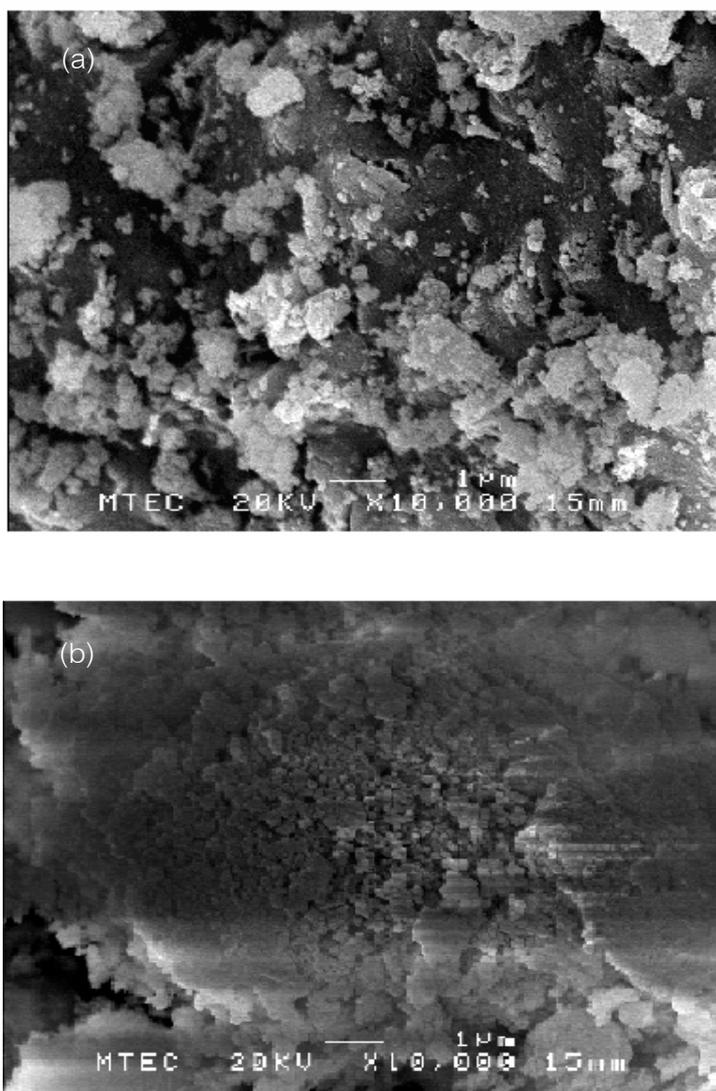


Figure F1 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from SPNO precursor calcination at different conditions: (a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h. The magnification (10,000x) is the same for all pictures.

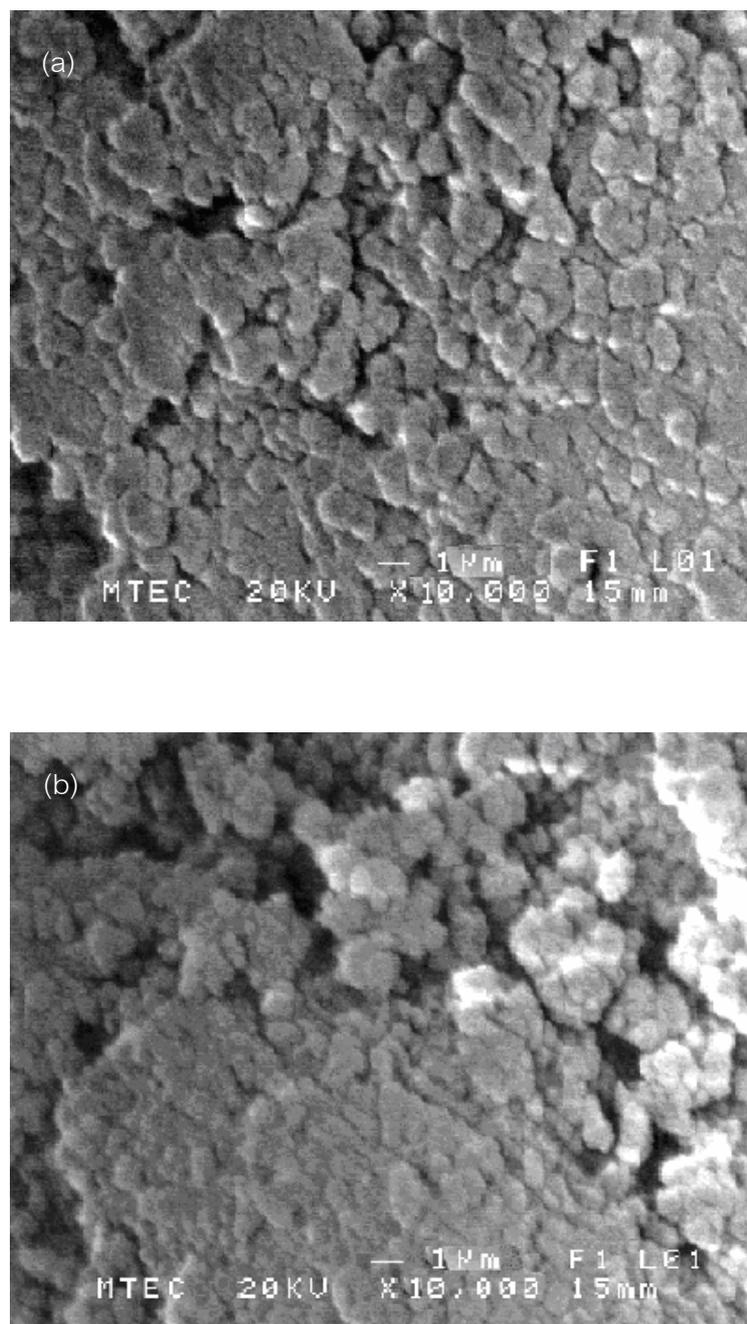


Figure F2 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from SPCI precursor calcination at different conditions: (a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h. The magnification (10,000x) is the same for all pictures.

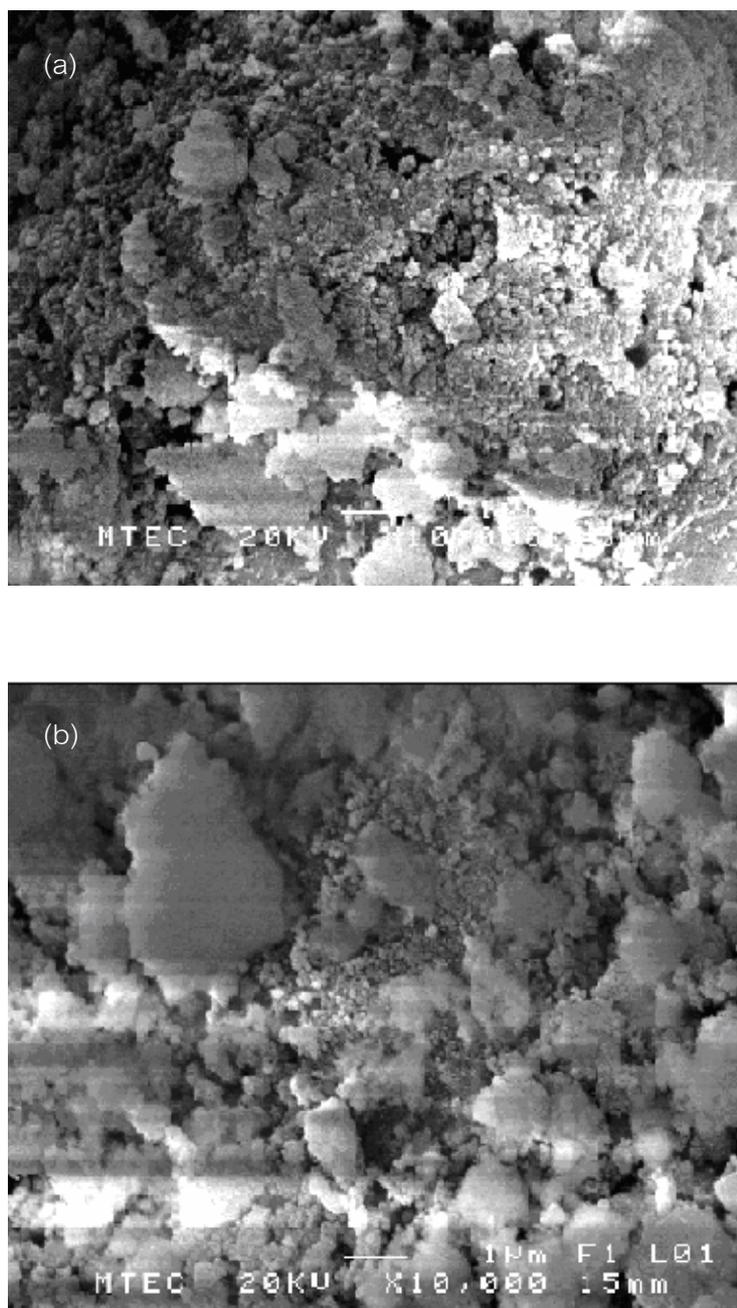


Figure F3 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from SPOH precursor calcination at different conditions: (a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h. The magnification (10,000x) is the same for all pictures.

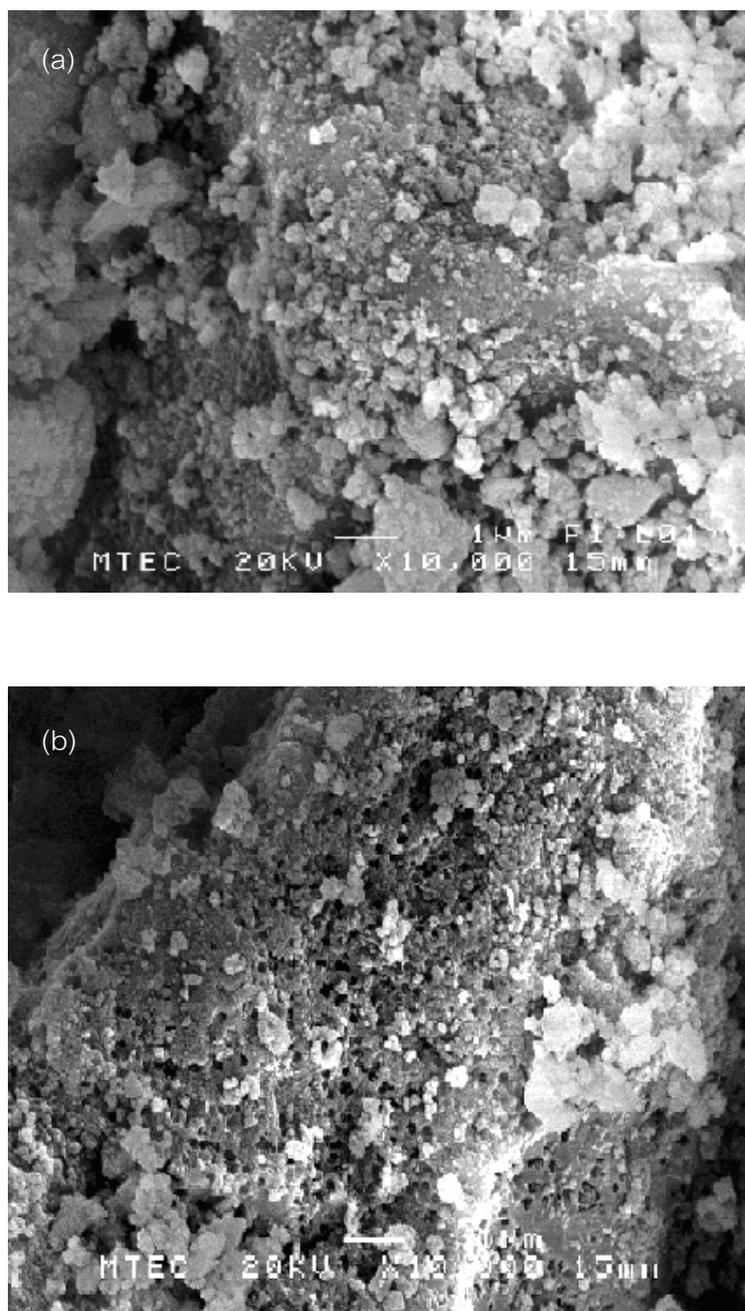
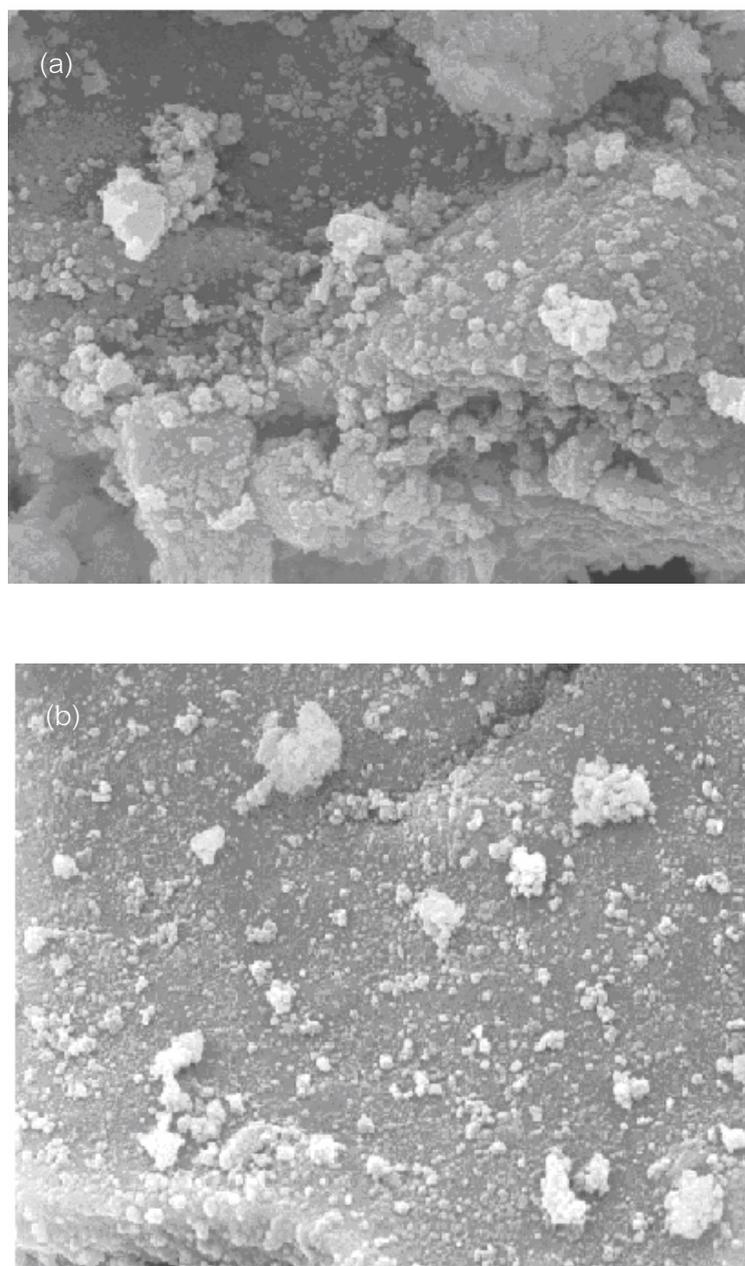


Figure F4 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from SPAC precursor calcination at different conditions: (a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h. The magnification (10,000x) is the same for all pictures.



**Figure F5** SEM micrographs of the NiAl<sub>2</sub>O<sub>4</sub> powder obtained from gel occurring at room temperature in the system of 20.0 % (w/v) in ethanolic solution of SPNO precursor with pH 10.0 and calcination at different conditions: (a) 1000°C for 5 h (b) 500°C for 5 h and held at 1000°C for 5 h. The magnification (10,000x) is the same for all pictures.

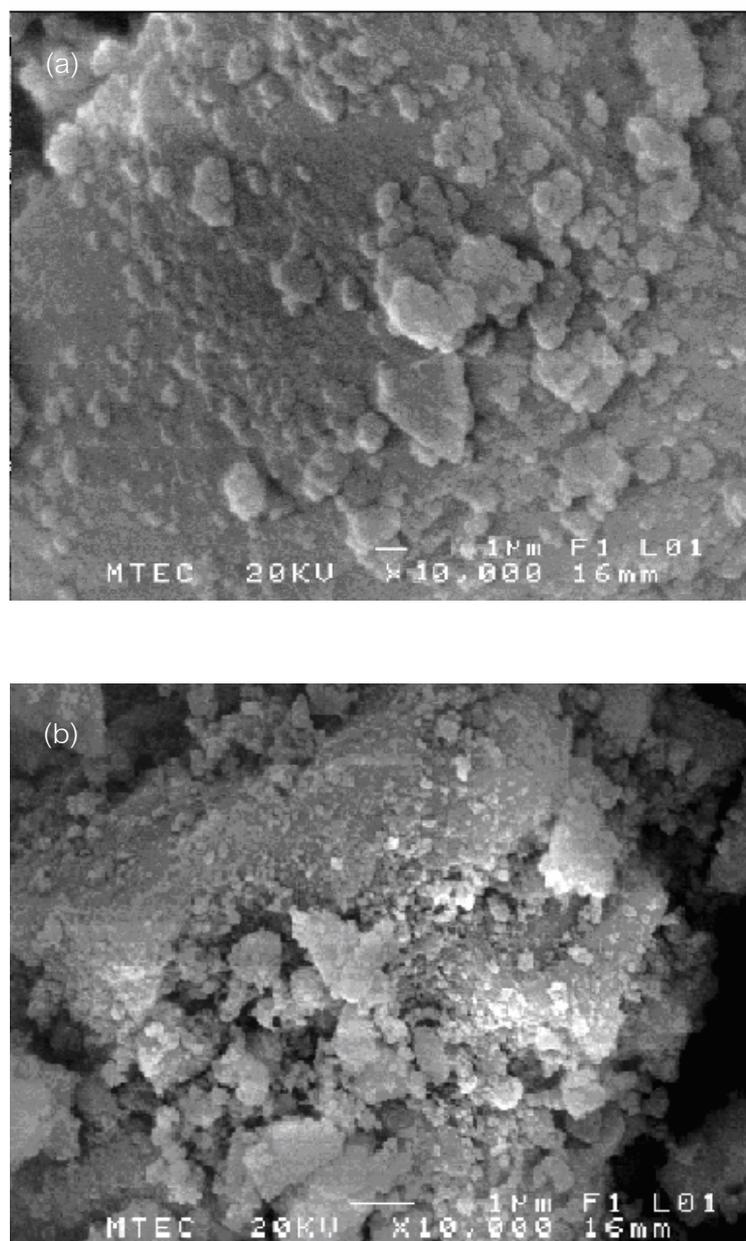


Figure F6 SEM micrographs of the NiAl<sub>2</sub>O<sub>4</sub> powder obtained from gel occurring at room temperature in the system of 24.0 % (w/v) in ethanolic solution of SPNO precursor with pH 8.0 and calcination at different conditions:  
(a) 1000°C for 5 h (b) 500°C for 5 h and held at 1000°C for 5 h.  
The magnification (10,000x) is the same for all pictures.

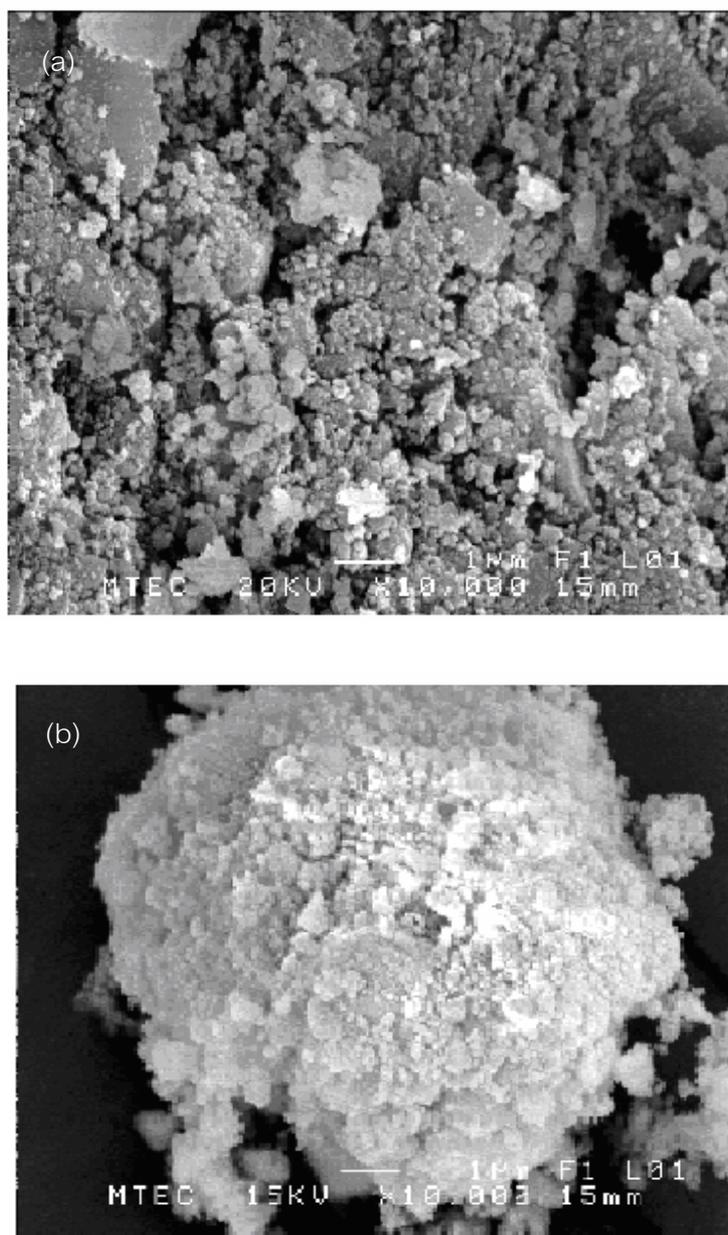


Figure F7 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from gel occurring at  $60^\circ\text{C}$  in the system of 24.0 % (w/v) in ethanolic solution of SPNO precursor with pH 9.0 and calcination at different conditions: (a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h. The magnification (10,000x) is the same for all pictures.

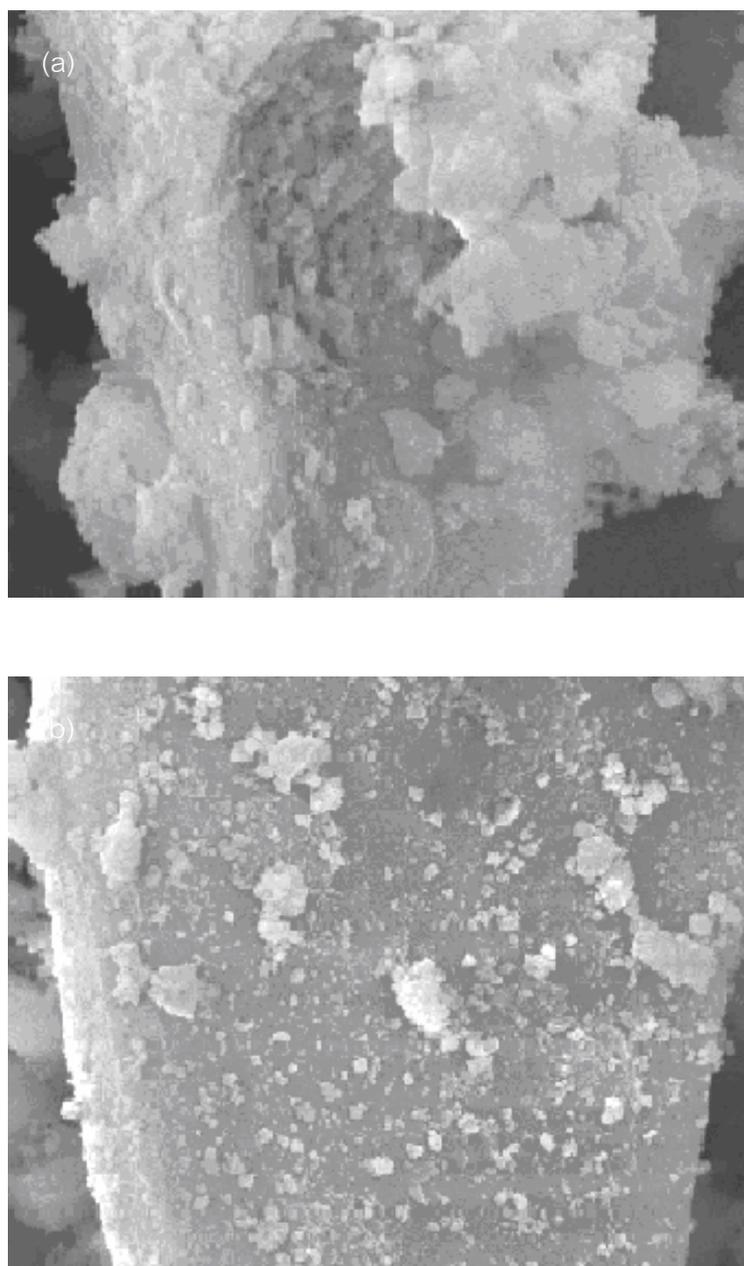


Figure F8 SEM micrographs of the NiAl<sub>2</sub>O<sub>4</sub> powder obtained from gel occurring at room temperature in the system of 24.0 % (w/v) in ethanolic solution of SPNO precursor with pH 10.0 and calcination at different conditions: (a) 1000°C for 5 h (b) 500°C for 5 h and held at 1000°C for 5 h. The magnification (10,000x) is the same for all pictures.

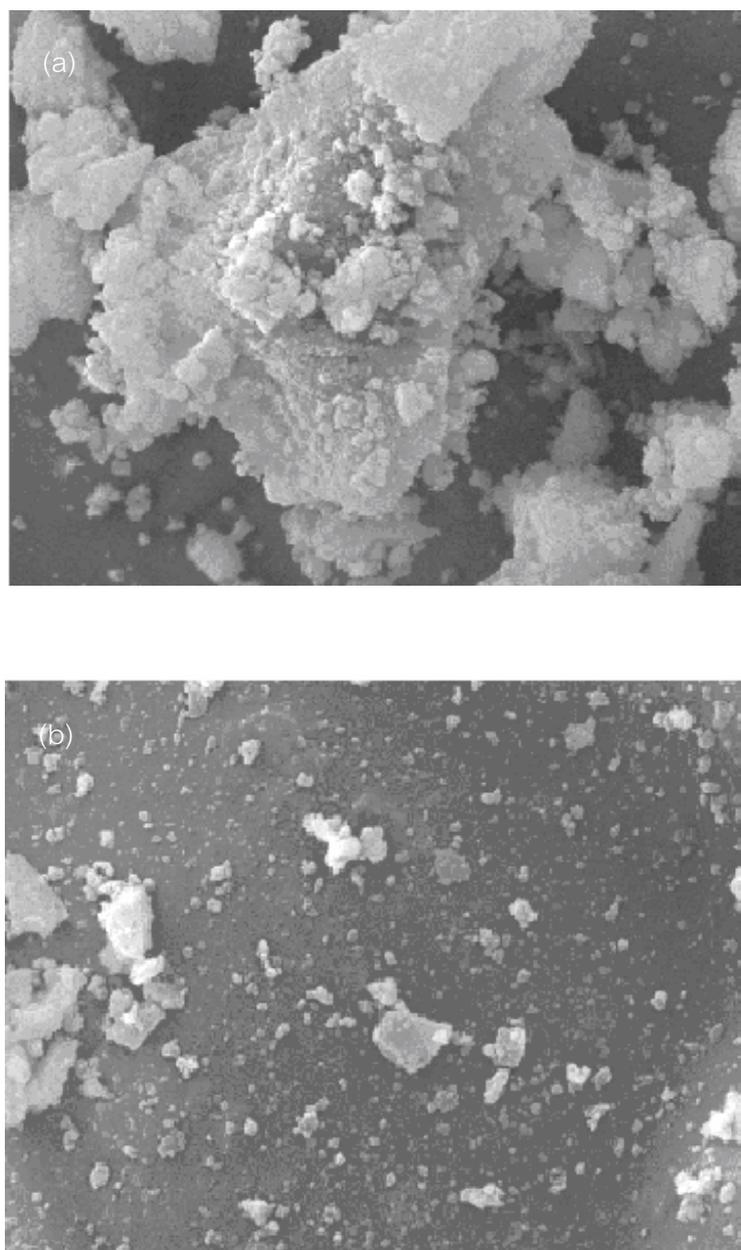


Figure F9 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from gel occurring at room temperature in the system of 28.0 % (w/v) in ethanolic solution of SPNO precursor with pH 7.0 and calcination at different conditions:  
(a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h.  
The magnification (10,000x) is the same for all pictures.

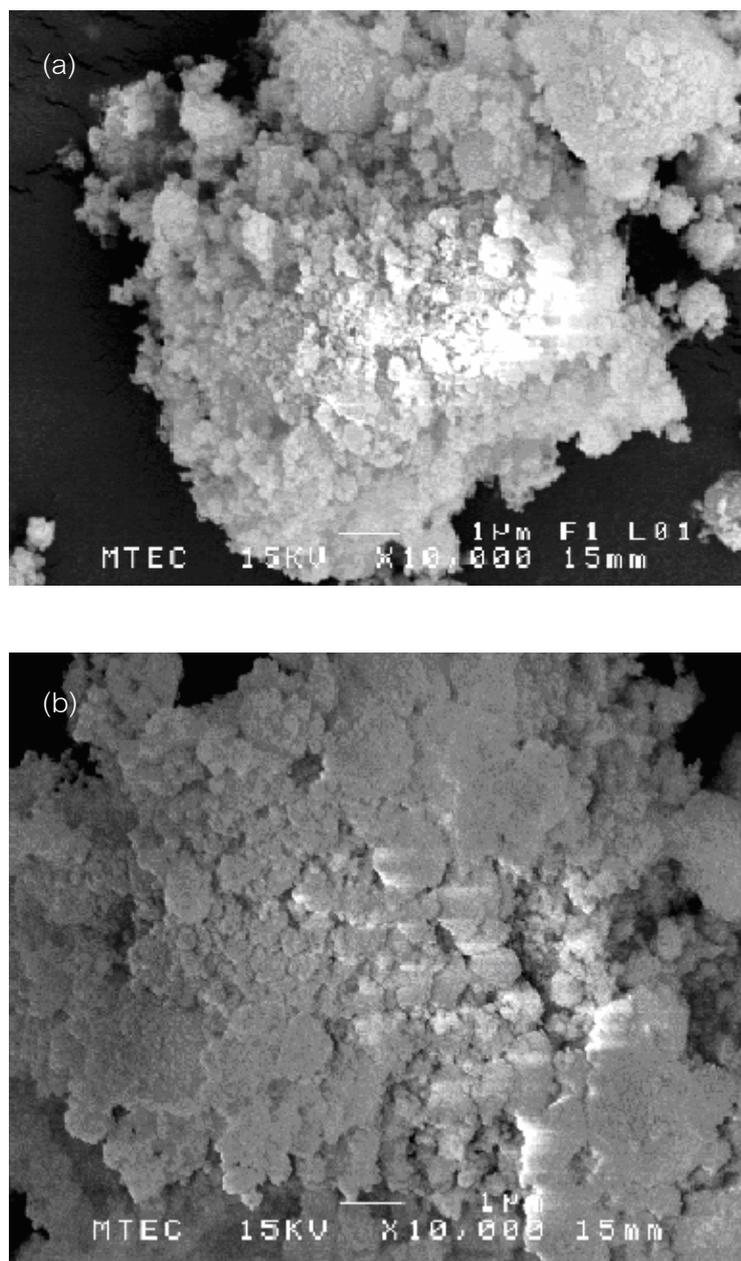


Figure F10 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from gel occurring at room temperature in the system of 28.0 % (w/v) in ethanolic solution of SPNO precursor with pH 8.0 and calcination at different conditions: (a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h. The magnification (10,000x) is the same for all pictures.

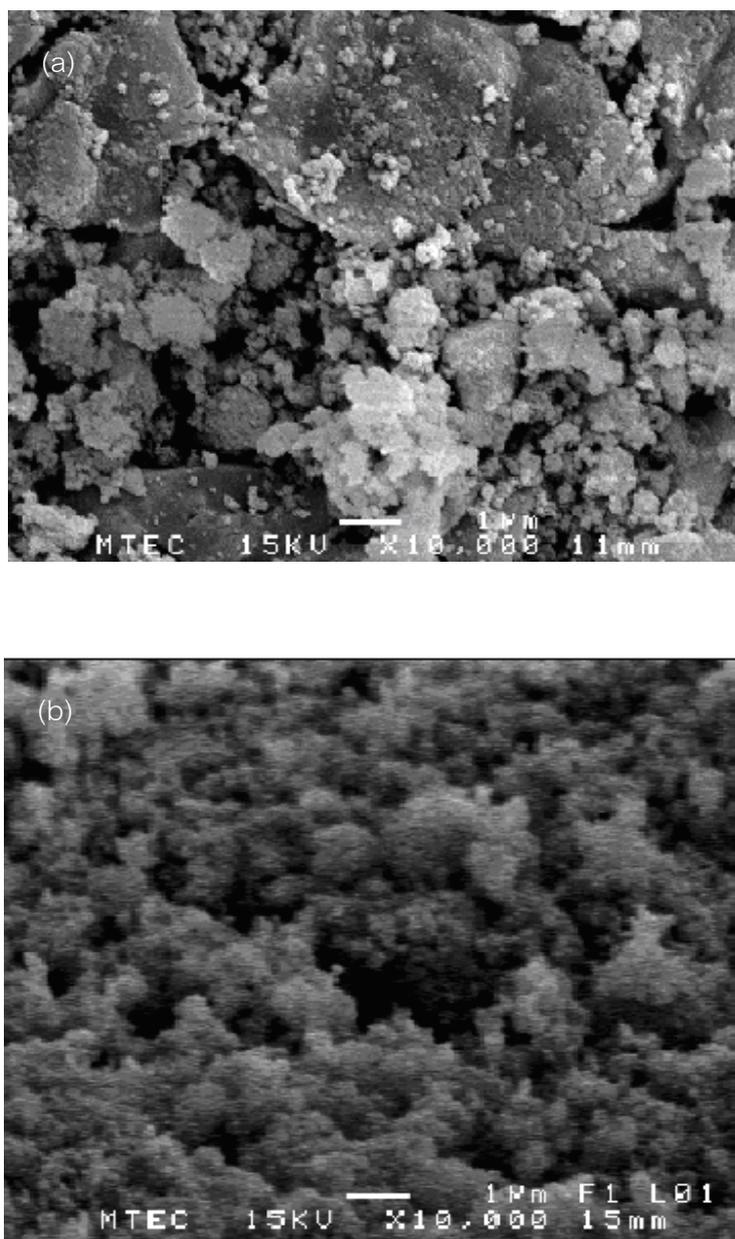


Figure F11 SEM micrographs of the NiAl<sub>2</sub>O<sub>4</sub> powder obtained from gel occurring at 60 °C in the system of 28.0 % (w/v) in ethanolic solution of SPNO precursor with pH 9.0 and calcination at different conditions: (a) 1000 °C for 5 h (b) 500 °C for 5 h and held at 1000 °C for 5 h. The magnification (10,000x) is the same for all pictures.

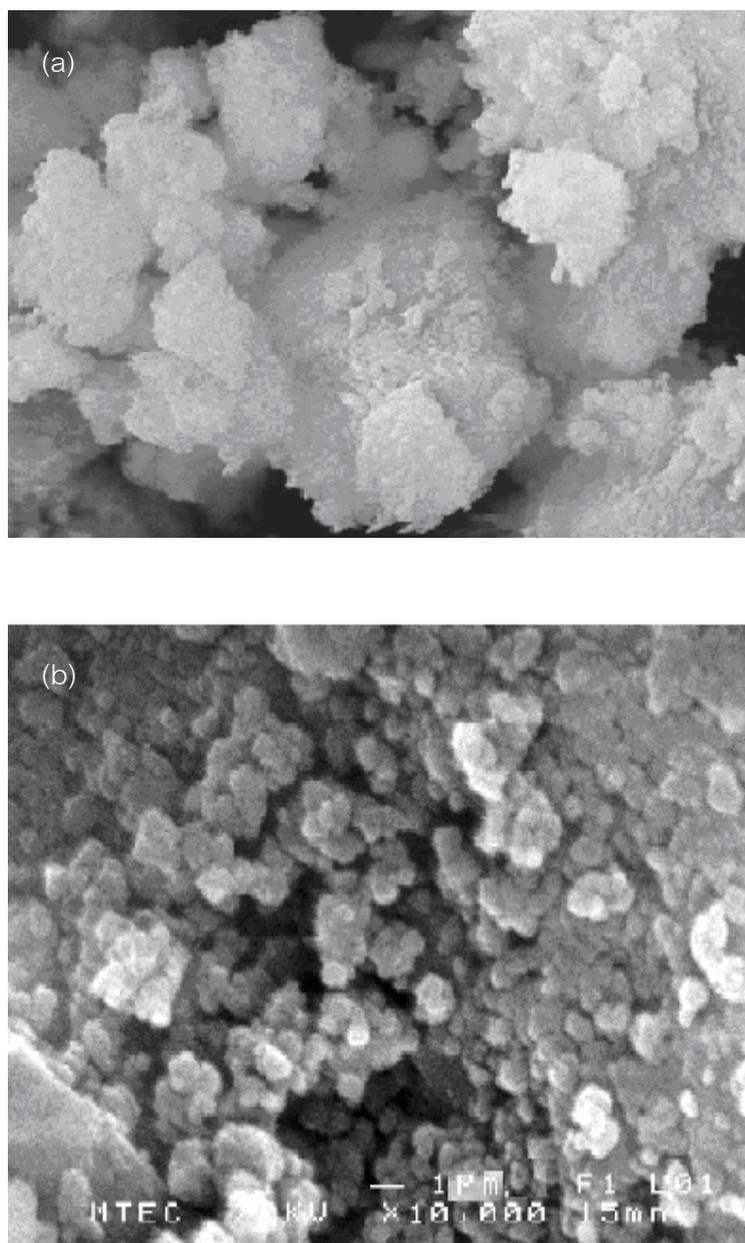


Figure F12 SEM micrographs of the NiAl<sub>2</sub>O<sub>4</sub> powder obtained from gel occurring at room temperature in the system of 28.0 % (w/v) in ethanolic solution of SPNO precursor with pH 10.0 and calcination at different conditions:  
(a) 1000°C for 5 h (b) 500°C for 5 h and held at 1000°C for 5 h.  
The magnification (10,000x) is the same for all pictures.

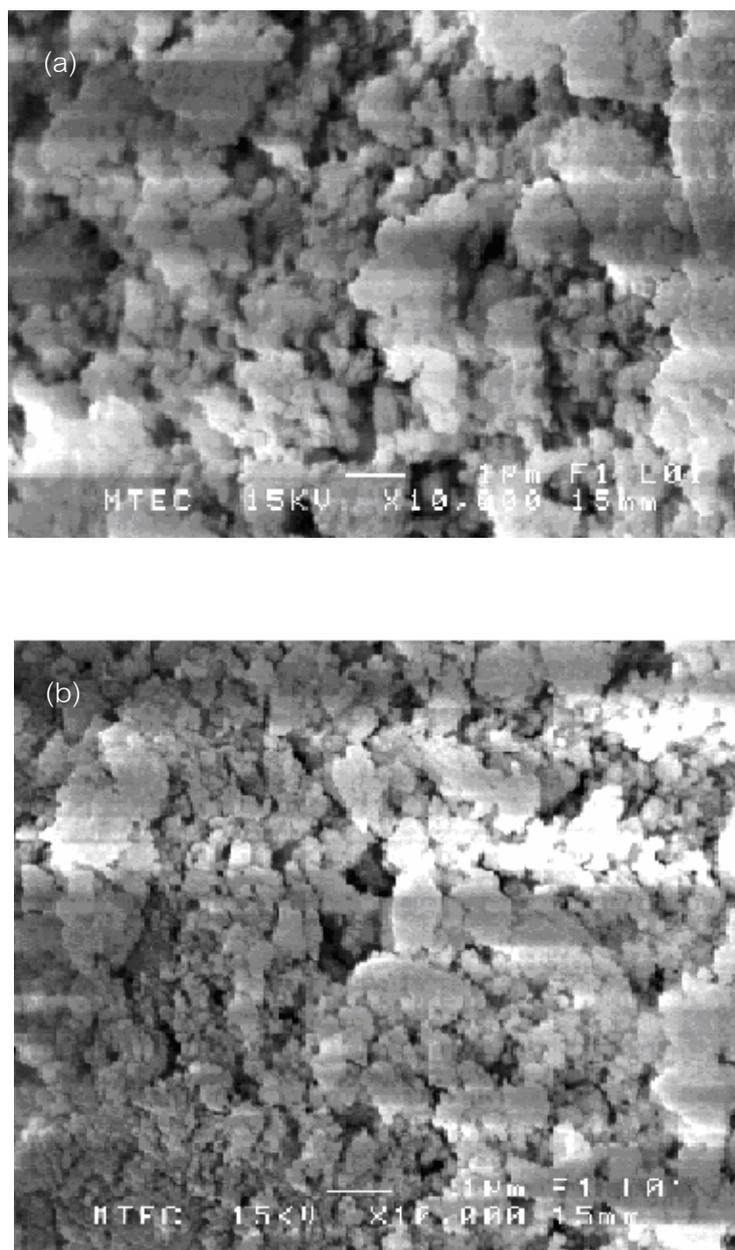


Figure F13 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from gel occurring at room temperature in the system of 28.0 % (w/v) in n-propanolic solution of SPNO precursor with pH 9.0 and calcination at different conditions:  
(a)  $1000^\circ\text{C}$  for 5 h (b)  $500^\circ\text{C}$  for 5 h and held at  $1000^\circ\text{C}$  for 5 h.  
The magnification (10,000x) is the same for all pictures.

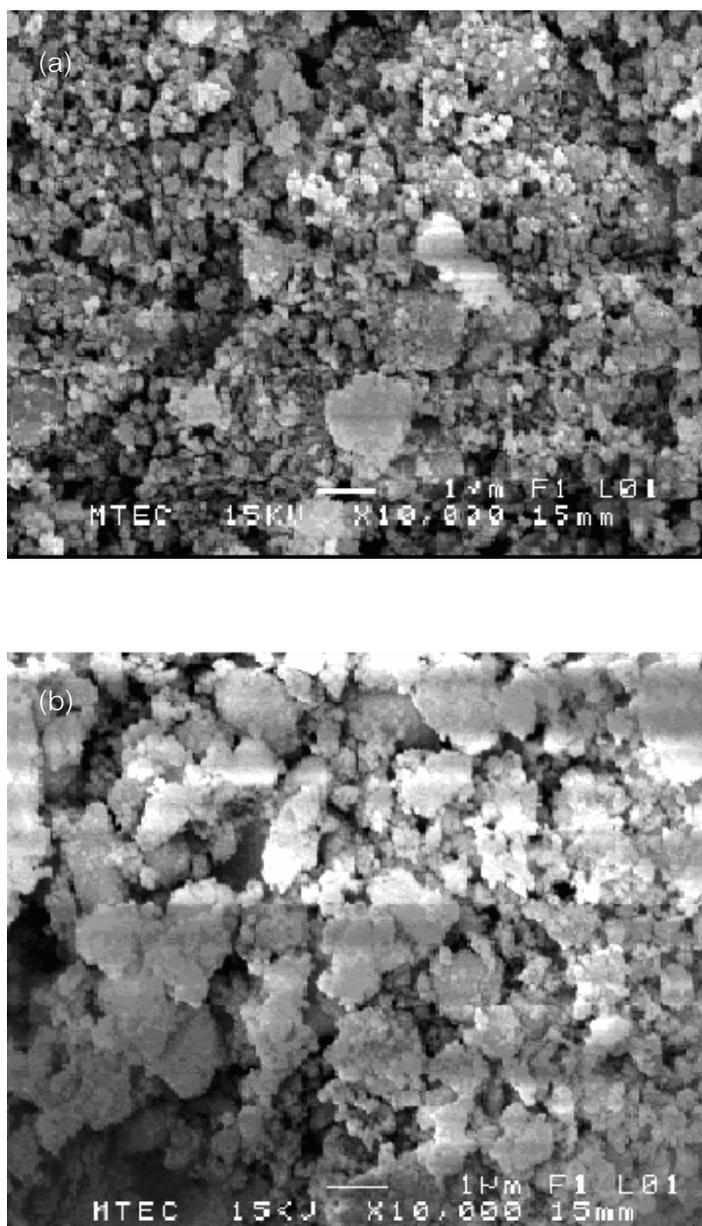


Figure F14 SEM micrographs of the  $\text{NiAl}_2\text{O}_4$  powder obtained from gel occurring at room temperature in the system of 32.0 % (w/v) in n-propanolic solution of SPNO precursor with pH 9.0 and calcination at different conditions: (a) 1000°C for 5 h (b) 500°C for 5 h and held at 1000°C for 5 h. The magnification (10,000x) is the same for all pictures.

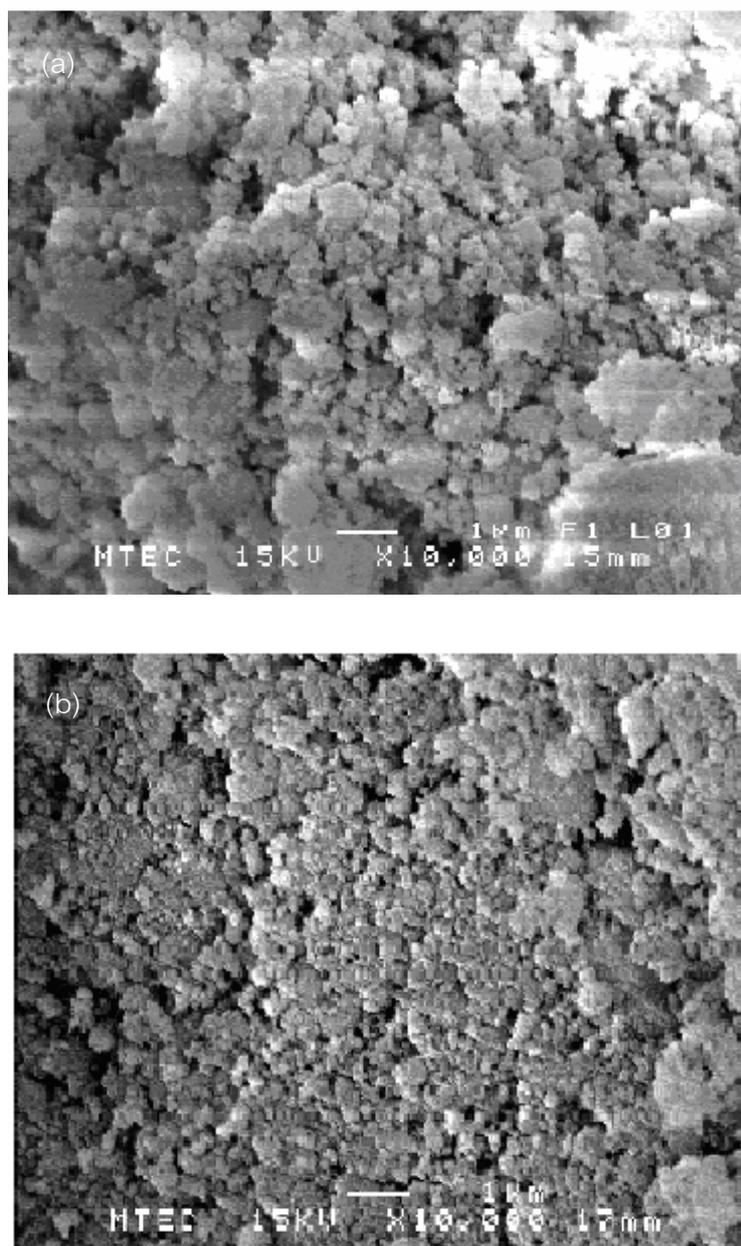


Figure F15 SEM micrographs of the NiAl<sub>2</sub>O<sub>4</sub> powder obtained from gel occurring at 60 °C in the system of 32.0 % (w/v) in ethanolic solution of SPNO precursor with pH 9.0 and calcination at different conditions: (a) 1000°C for 5 h (b) 500°C for 5 h and held at 1000°C for 5 h. The magnification (10,000x) is the same for all pictures.