

Electronic Support Information

Phase formation in $\text{NaH}_2\text{PO}_4\text{--VOSO}_4\text{--NaF--H}_2\text{O}$ system and rapid synthesis of $\text{Na}_3\text{V}_2\text{O}_{2x}(\text{PO}_4)_2\text{F}_{3-2x}$

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Figure S1 Photos of samples without adding sodium fluoride and 1 day's synthesis (a), with a F/V molar ratio of 0.1 in starting mixture and 1 day's synthesis (b) and 3 days' synthesis (c).

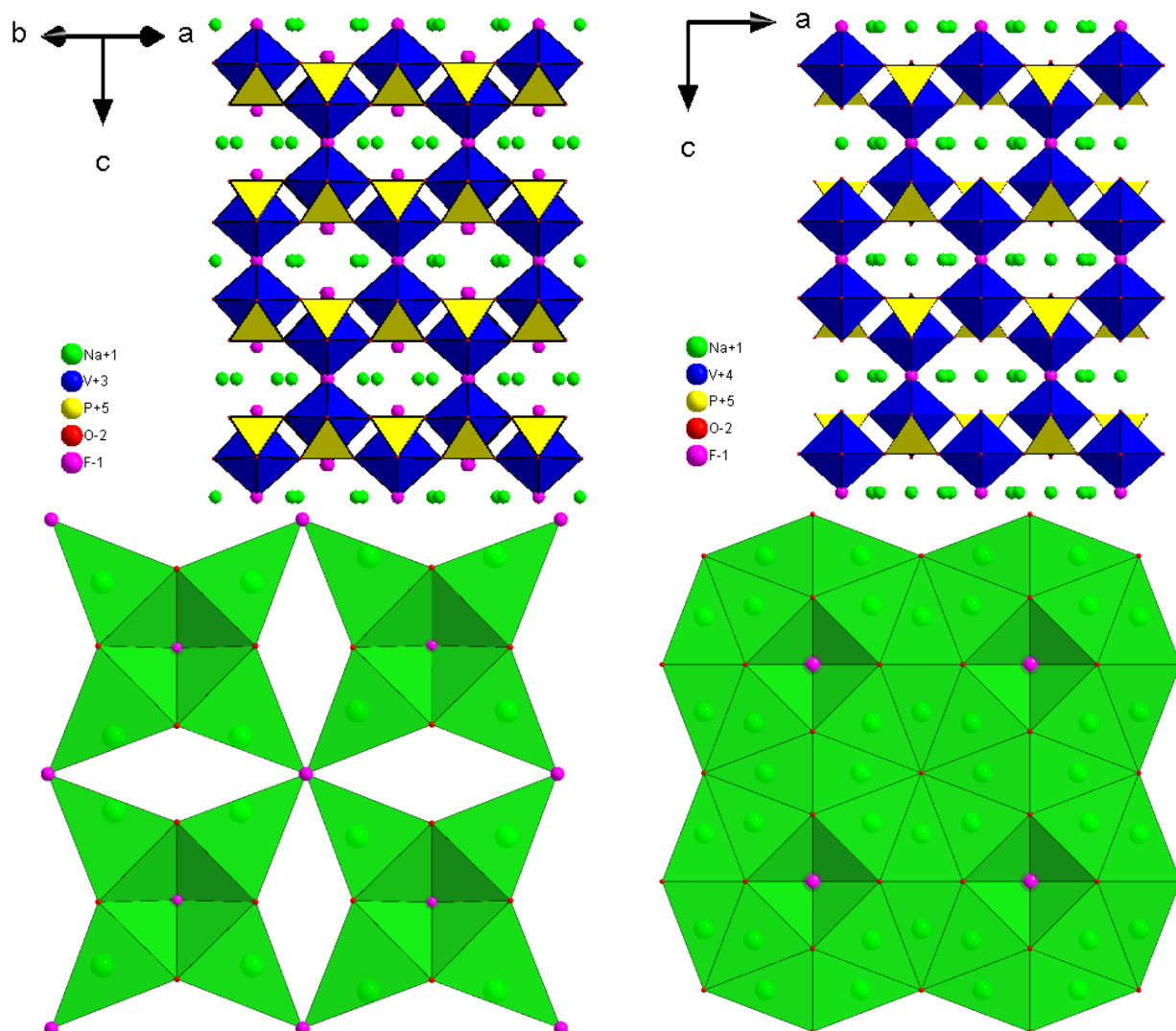


Figure S2 Structure representations of $\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{F}_3$ (top left), $\text{Na}_3(\text{VO})_2(\text{PO}_4)_2\text{F}$ (top right) and sodium positions in the structure (bottom).

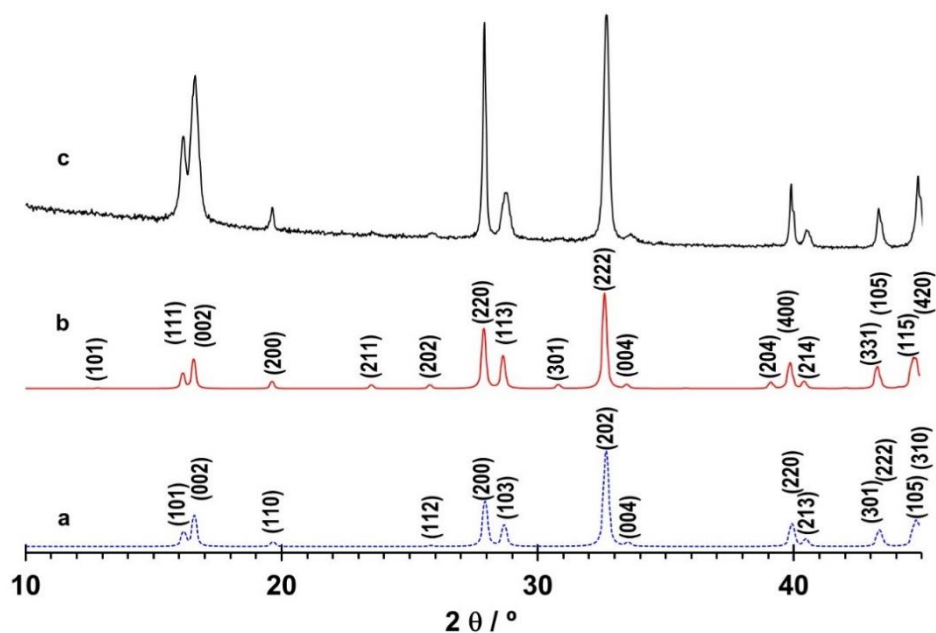


Figure S3 Powder XRD patterns of simulated ones for $\text{Na}_3(\text{VO})_2(\text{PO}_4)_2\text{F}$ (a) and $\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{F}_3$ (b); and for a sample with a F/V molar ratio of 0.7 in starting mixture and synthesized at 170 °C for 1 day (c).

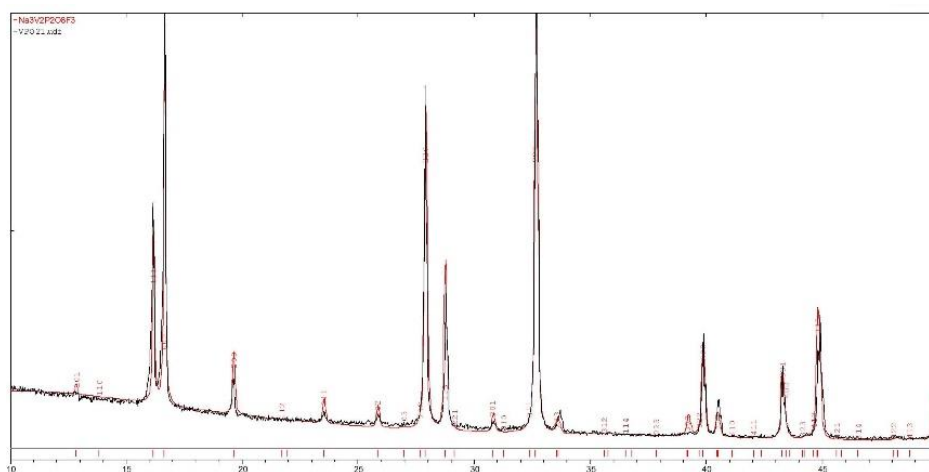


Figure S4 Cell parameter fit using space group $\text{P4}_2/\text{mmn}$.

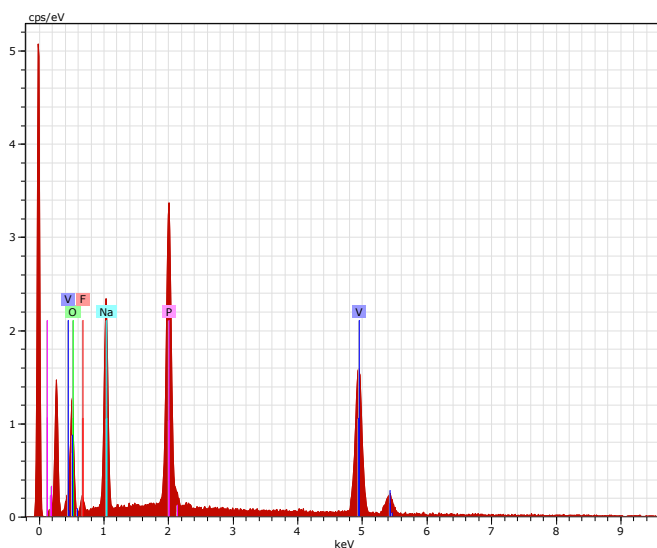


Figure S5 Energy dispersive X-ray spectrometry of a sample with a F/V molar ratio of 0.7 in starting mixture and synthesized at 170 °C for 1 day.

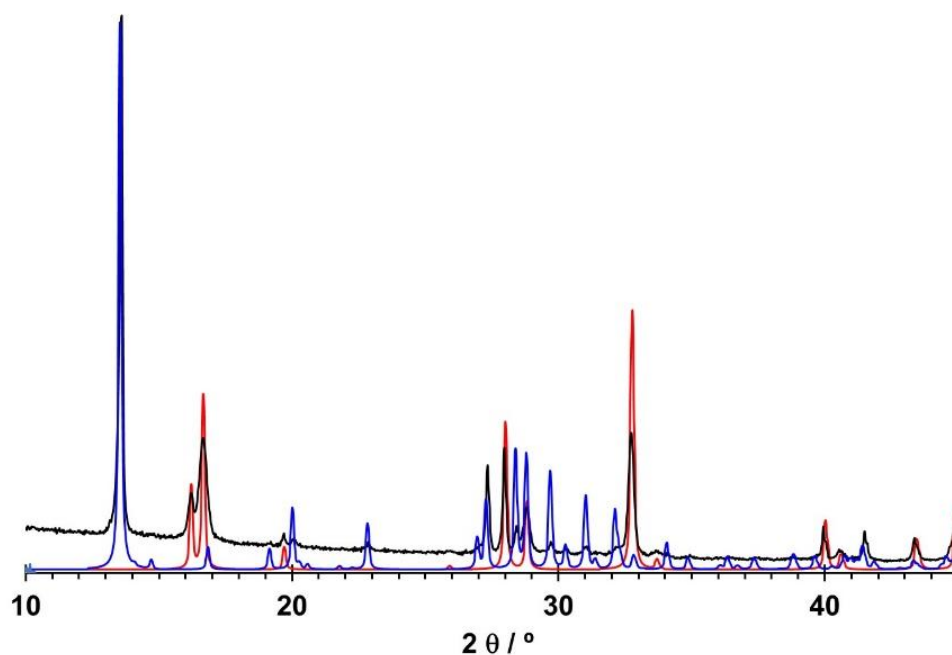


Figure S6 Powder XRD patterns of simulated ones for $\text{Na}(\text{VO})_2(\text{PO}_4)_2(\text{H}_2\text{O})_4$ (blue) and $\text{Na}_3(\text{VO})_2(\text{PO}_4)_2\text{F}$ (red); and for a sample with a F/V molar ratio of 0.7 in starting mixture and synthesized at 170°C for 3 day (black).

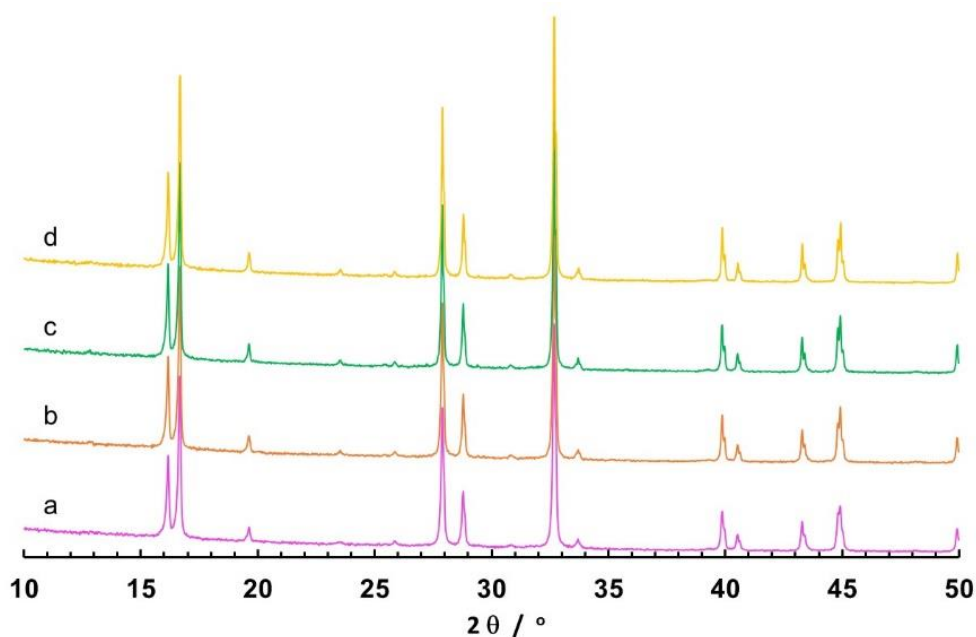


Figure S7 Powder XRD patterns of samples with a F/V molar ratio of 2.1 and synthesized at 170°C for 1 day (a); 3 days (b); and with double amount of water and synthesized at 170°C for 1 day (c); 3 days (d).

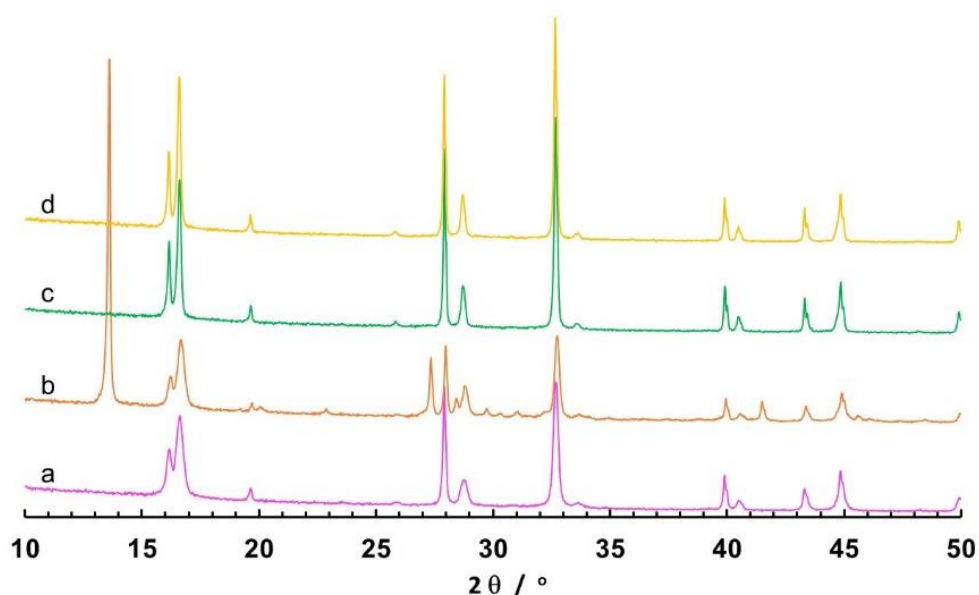


Figure S8 Powder XRD patterns of samples with a F/V molar ratio of 0.7 and synthesized at 170 °C for 1 day (a); 3 days (b); and with double amount of water and synthesized at 170 °C for 1 day (c); 3 days (d).

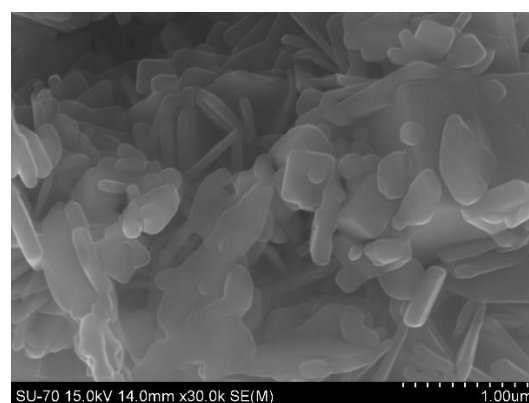
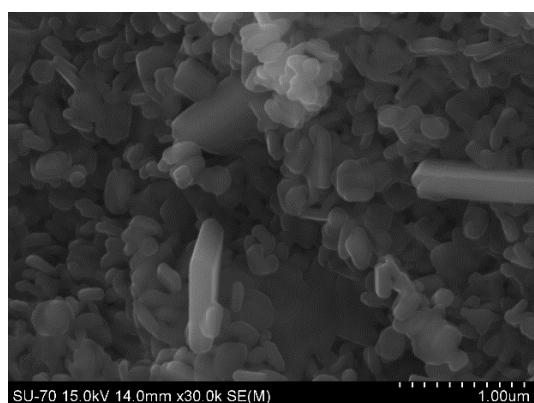


Figure S9 SEM of samples with a F/V molar ratio of 0.7, a H₂O/V molar ratio of 70 (left) and 140 (right) in starting mixture and synthesized at 170 °C for 1 day.

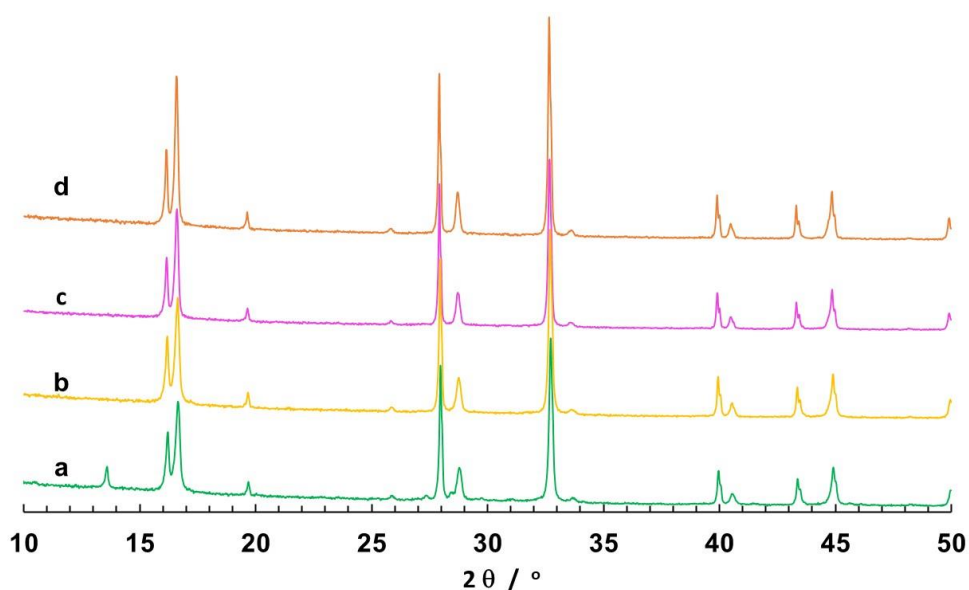


Figure S10 Powder XRD patterns of samples with a F/V molar ratio of 0.7 in starting mixture and synthesized at 170 °C for 2 hours (a), 5 hours (b), 1 day (c) and 3 days (d).

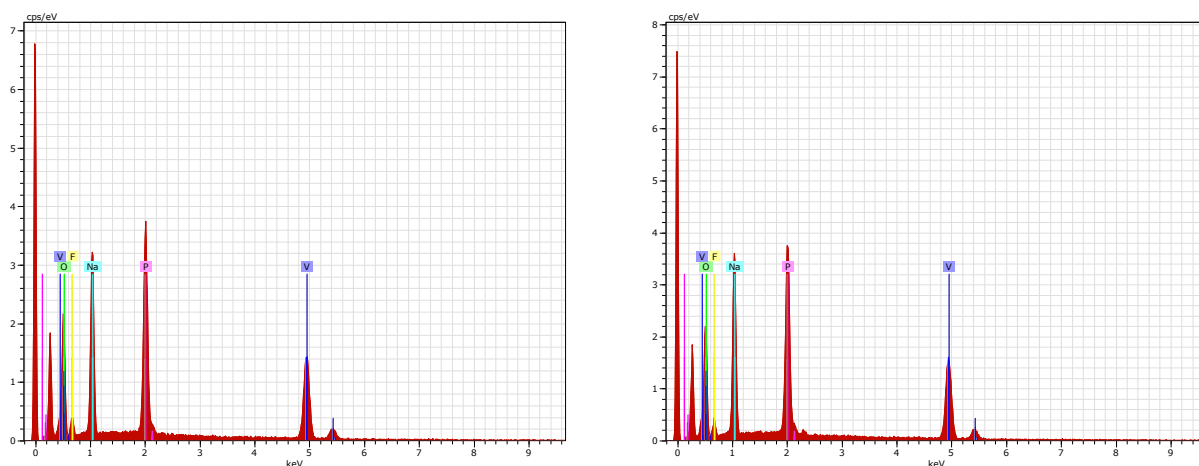


Figure S11 Energy dispersive X-ray spectrometry of samples with a $\text{H}_2\text{O}/\text{V}$ molar ratio of 140 in starting mixture and synthesized at 170 °C for 2 hours with a F/V molar ratio of 2.1 (left) and 5 hours with a F/V molar ratio of 0.7 (right), respectively.

Table S1. FT-IR peaks of selected samples (See sample number in Table 1).

sample					V-O	V-F	
3	1138			1045	926	952	793
8					921	948	795
9	1138	1122	1053	1043	922	952	795
10	1139	1127	1056	1042	926	952	789
5	1155	1118	1061		918	948	no
6	1159	1119	1059		918	945	no
13	1155	1121	1061		919	950	no
11	1155	1121	1057	1040	919	weak	weak