# Supporting Information

# Strategy for Enhancement of Magnesium Ions Diffusion in Vanadium Tetra Sulfide-Layered Structure for Rechargeable Magnesium Batteries

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## S-1: Chemicals and Materials

The reagents and chemicals were of analytical grade and were used without prior treatment or purification. Ammonium metavanadate ($NH_4VO_3$) purchased from Meryer Co. Ltd., Thioacetamide (TAA) and nickel acetate tetrahydrate (as Ni source) were bought from Shanghai Aladdin Bio-Chem Technology Co. Ltd and ethylene glycol (EG) were taken from Sinopharm Chemical Reagent Co. Ltd.

**S-2: Preparation of the $VS_4$ Electrode** - The synthesized $VS_4$ sample, conductive carbon black (Super P), and polyvinylidene fluoride (PVDF) with mass ratio of 7:2:1, respectively were mixed and grinding for a certain time, the powder was dissolved using solvent N-methyl-2-pyrrolidone (NMP) to obtain the slurry. The slurry was then coated onto the copper current collector that had been cut into discs thereafter in diameter 11mm and dried at 80°C for 12h.

**S-3: Coin Cell Assembly -** Gloves box was used for assembly of the coin type batteries for electrochemical measurements. The counter electrode selected was a high-purity Magnesium foil (99.995%, about 0.2 mm thick), it was washed in mild hydrochloric acid to remove oxide layer and surface activation. Glass fibers (Whatman, GF/D grade) were chosen as the separator

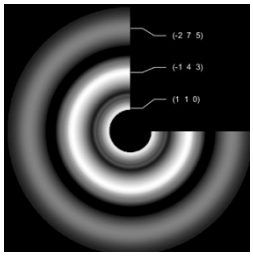
to prevent short circuit. Phenolate-based magnesium complex (PMC) electrolyte, 0.25mol/L (R-PhOMgCl)$_2$-AlCl$_3$/ THF) solution, where R is the alkyl group of 2-tert-butyl-4-methylphenol, were used as electrolyte in coin cells due to its reported high efficiency.

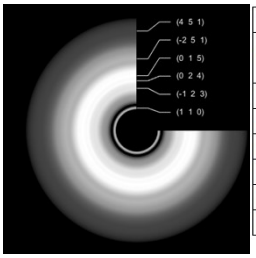
**S-4: Preparation of Electrolyte -** PMC electrolyte prepared in a glovebox filled with argon (both O and OH contents were maintained less than 0.01 ppm) at ambient temperature. Initially, 0.1333g anhydrous AlCl$_3$ (99.99%from Alfa Aesar) was dissolved in 2mL anhydrous tetrahydrofuran (THF, 99.99% from TCI) followed by stirring for 12h at 500rpm to obtain 0.5 mol/L AlCl3/THF solution. In the meantime, 0.3284g 2-tert-butyl-4-methylphenol (99.9 % from Alfa Aesar) was added to 1mL anhydrous THF followed by stirring for 2h at 500rpm. The prepared solution is denoted as R-PhOH/THF where R represents the group of 2-tert-butyl-4-methylphenol. Then, 1mL ethyl magnesium chloride solution (2 mol/L from Aladdin) was added dropwise to the R-PhOH/THF solution, the dropwise addition is due to safety because it produces a lot of bubbles and releasing heat. Subsequently, the obtained solution was stirred for another 10h at 500rpm to obtain R-PhOMgCI/THF solution. Finally, 2.0mL AlCl$_3$/THF solution was mixed with 2.0mL R-PhOMgCl/THF solution to make 0.25mol/L (R-PhOMgCI)$_2$-A1Cl$_3$/THF solution, which is the PMC electrolyte used in these coin cells.[1]

**S-5: SAED Analysis**

$VS_4$

| Ring identification | | | | |
|---|---|---|---|---|
| Plane | Radius [1/nm] | | d-spacing [nm] | |
| | theor. | measured | theor. | measured |
| (1 1 0) | 1.783 | 1.817 | 0.561 | 0.550 |
| (-1 4 3) | 4.683 | 4.678 | 0.214 | 0.214 |
| (-2 7 5) | 8.191 | 8.196 | 0.122 | 0.122 |

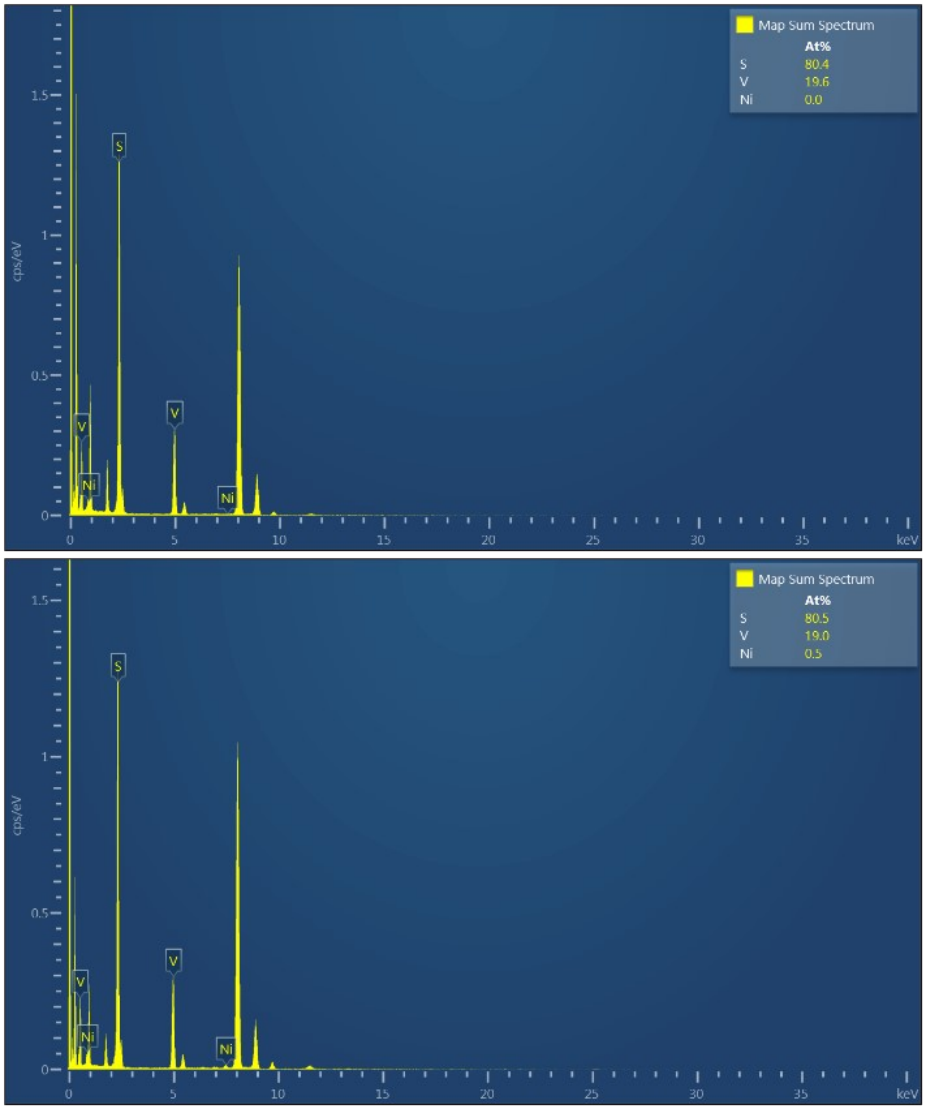



| Ring identification | 5% Ni-$VS_4$ | | | |
|---|---|---|---|---|
| Plane | Radius [1/nm] | | d-spacing [nm] | |
| | theor. | measured | theor. | measured |
| (1 1 0) | 1.783 | 1.754 | 0.561 | 0.570 |
| (-1 2 3) | 3.299 | 3.315 | 0.303 | 0.302 |
| (0 2 4) | 3.872 | 3.912 | 0.258 | 0.256 |
| (0 1 5) | 4.311 | 4.317 | 0.232 | 0.232 |
| (-2 5 1) | 5.641 | 5.647 | 0.177 | 0.177 |
| (4 5 1) | 7.858 | 7.844 | 0.127 | 0.127 |

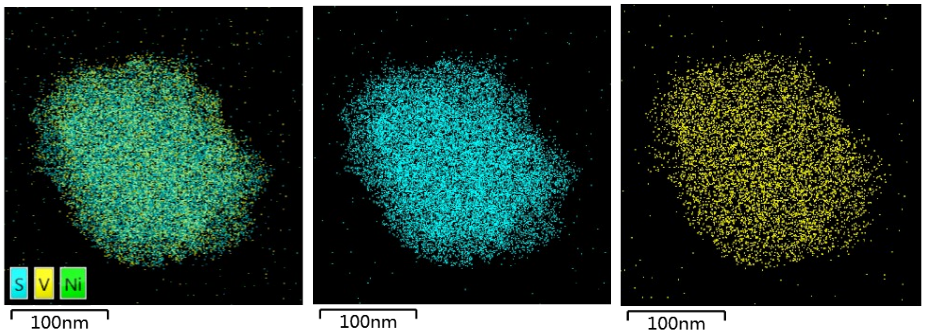
SAED image and table is showing that d spacing has been increased after nickel substitution. it was 0.550nm at 110 plane of $VS_4$, which was increased to 0.57nm after substitution of 5% Ni contents.

## S-6: EDS Mapping




### Elemental Mapping of $VS_4$

Dispersion of all elements are uniformly distributed. There is no Ni in pure $VS_4$



**S-7: Table 1** Calculated sulfur (S) contents in typical metal sulfides and theoretical specific capacities based on full conversion reactions.

| Cathodes for RMBS | Sulfur Contents (% wt.) | Full Conversion Reaction | Theoretical Specific Capacity (TSC), mAh/g |
|---|---|---|---|
| **S** | 100 | $Mg + S \leftrightarrow MgS$ | 1675 |
| **$VS_4$** | 71.6 | $Mg + VS_4 \leftrightarrow MgS + 4V$ | 1199 |
| **$FeS_2$** | 53.4 | $Mg + FeS_2 \leftrightarrow 2MgS + Fe$ | 894 |
| **$CoS_2$** | 52.1 | $Mg + CoS_2 \leftrightarrow 2MgS + Co$ | 873 |
| **$NiS_2$** | 52.2 | $Mg + NiS_2 \leftrightarrow 2MgS + Ni$ | 874 |
| **CuS** | 33.5 | $Mg + CuS \leftrightarrow MgS + Cu$ | 561 |
| **$Cu_2S$** | 20.1 | $Mg + Cu_2S \leftrightarrow MgS + 2Cu$ | 336 |

This table is based on hypothetical full conversion reactions-based calculation of capacitance, which shows $VS_4$ an Ideal candidate. However practically it could be an ideal condition only.

**S-8: Table 2** *Cell vectors (a, b, and c) in Å and atomic positions in fractional coordinates for $VS_4$ computed with PBE*

| | *x* | *y* | *c* |
|---|---|---|---|
| *a* | 16.16479 | 0.000414 | 0.040128 |
| *b* | -2.29844 | 16.00055 | -0.04013 |
| *c* | -1.91365 | 1.65836 | 6.900307 |
| V | 0.308097 | 0.441988 | 0.117446 |
| V | 0.308097 | 0.941988 | 0.117446 |
| V | 0.808097 | 0.441988 | 0.117446 |
| V | 0.808097 | 0.941988 | 0.117446 |
| V | 0.191903 | 0.058012 | 0.882554 |
| V | 0.191903 | 0.558012 | 0.882554 |
| V | 0.691903 | 0.058012 | 0.882554 |

| | | | |
|---|---|---|---|
| V | 0.691903 | 0.558012 | 0.882554 |
| V | 0.441988 | 0.308097 | 0.382554 |
| V | 0.441988 | 0.808097 | 0.382554 |
| V | 0.941988 | 0.308097 | 0.382554 |
| V | 0.941988 | 0.808097 | 0.382554 |
| V | 0.058012 | 0.191903 | 0.617446 |
| V | 0.058012 | 0.691903 | 0.617446 |
| V | 0.558012 | 0.191903 | 0.617446 |
| V | 0.558012 | 0.691903 | 0.617446 |
| S | 0.086249 | 0.343082 | 0.539942 |
| S | 0.086249 | 0.843082 | 0.539942 |
| S | 0.586249 | 0.343082 | 0.539942 |
| S | 0.586249 | 0.843082 | 0.539942 |
| S | 0.495497 | 0.202279 | 0.280952 |
| S | 0.495497 | 0.702279 | 0.280952 |
| S | 0.995497 | 0.202279 | 0.280952 |
| S | 0.995497 | 0.702279 | 0.280952 |
| S | 0.413751 | 0.156918 | 0.460058 |
| S | 0.413751 | 0.656918 | 0.460058 |
| S | 0.913751 | 0.156918 | 0.460058 |
| S | 0.913751 | 0.656918 | 0.460058 |
| S | 0.202279 | 0.495497 | 0.219048 |
| S | 0.202279 | 0.995497 | 0.219048 |
| S | 0.702279 | 0.495497 | 0.219048 |
| S | 0.702279 | 0.995497 | 0.219048 |
| S | 0.158169 | 0.186576 | 0.941554 |
| S | 0.158169 | 0.686576 | 0.941554 |
| S | 0.658169 | 0.186576 | 0.941554 |
| S | 0.658169 | 0.686576 | 0.941554 |
| S | 0.399552 | 0.445683 | 0.426822 |
| S | 0.399552 | 0.945683 | 0.426822 |
| S | 0.899552 | 0.445683 | 0.426822 |
| S | 0.899552 | 0.945683 | 0.426822 |
| S | 0.054317 | 0.100448 | 0.926822 |
| S | 0.054317 | 0.600448 | 0.926822 |
| S | 0.554317 | 0.100448 | 0.926822 |
| S | 0.554317 | 0.600448 | 0.926822 |
| S | 0.297721 | 0.004503 | 0.780952 |
| S | 0.297721 | 0.504503 | 0.780952 |
| S | 0.797721 | 0.004503 | 0.780952 |
| S | 0.797721 | 0.504503 | 0.780952 |
| S | 0.004503 | 0.297721 | 0.719048 |
| S | 0.004503 | 0.797721 | 0.719048 |
| S | 0.504503 | 0.297721 | 0.719048 |
| S | 0.504503 | 0.797721 | 0.719048 |
| S | 0.313424 | 0.341831 | 0.441554 |
| S | 0.313424 | 0.841831 | 0.441554 |
| S | 0.813424 | 0.341831 | 0.441554 |
| S | 0.813424 | 0.841831 | 0.441554 |

| | | | |
|---|---|---|---|
| S | 0.100448 | 0.054317 | 0.573178 |
| S | 0.100448 | 0.554317 | 0.573178 |
| S | 0.600448 | 0.054317 | 0.573178 |
| S | 0.600448 | 0.554317 | 0.573178 |
| S | 0.445683 | 0.399552 | 0.073178 |
| S | 0.445683 | 0.899552 | 0.073178 |
| S | 0.945683 | 0.399552 | 0.073178 |
| S | 0.945683 | 0.899552 | 0.073178 |
| S | 0.341831 | 0.313424 | 0.058446 |
| S | 0.341831 | 0.813424 | 0.058446 |
| S | 0.841831 | 0.313424 | 0.058446 |
| S | 0.841831 | 0.813424 | 0.058446 |
| S | 0.156918 | 0.413751 | 0.039942 |
| S | 0.156918 | 0.913751 | 0.039942 |
| S | 0.656918 | 0.413751 | 0.039942 |
| S | 0.656918 | 0.913751 | 0.039942 |
| S | 0.186576 | 0.158169 | 0.558446 |
| S | 0.186576 | 0.658169 | 0.558446 |
| S | 0.686576 | 0.158169 | 0.558446 |
| S | 0.686576 | 0.658169 | 0.558446 |
| S | 0.343082 | 0.086249 | 0.960058 |
| S | 0.343082 | 0.586249 | 0.960058 |
| S | 0.843082 | 0.086249 | 0.960058 |
| S | 0.843082 | 0.586249 | 0.960058 |

**S-9: Table 3** *Cell vectors (a, b, and c) in Å and atomic positions in fractional coordinates for $V_S$:$VS_4$ computed with PBE*

| | *x* | *y* | *c* |
|---|---|---|---|
| *a* | 15.94954 | 0.751412 | -0.07151 |
| *b* | -1.52528 | 16.26632 | -0.70548 |
| *c* | -1.82345 | 1.2862 | 6.715258 |
| V | 0.313499 | 0.440565 | 0.098141 |
| V | 0.305336 | 0.938706 | 0.116781 |
| V | 0.808978 | 0.441273 | 0.11342 |
| V | 0.805552 | 0.944436 | 0.115183 |
| V | 0.190131 | 0.056323 | 0.882674 |
| V | 0.195525 | 0.558151 | 0.88773 |
| V | 0.694545 | 0.061581 | 0.869726 |
| V | 0.694657 | 0.559068 | 0.87761 |
| V | 0.44375 | 0.307771 | 0.373737 |
| V | 0.44187 | 0.806546 | 0.379564 |
| V | 0.942754 | 0.308673 | 0.379881 |
| V | 0.938653 | 0.807912 | 0.388255 |
| V | 0.056787 | 0.191071 | 0.61834 |
| V | 0.055847 | 0.690868 | 0.627629 |
| V | 0.557079 | 0.192029 | 0.617978 |
| V | 0.560249 | 0.691886 | 0.614556 |
| S | 0.091965 | 0.331387 | 0.518603 |

| | | | |
|---|---|---|---|
| S | 0.088274 | 0.830774 | 0.517362 |
| S | 0.583968 | 0.324923 | 0.512184 |
| S | 0.590817 | 0.833005 | 0.512 |
| S | 0.465408 | 0.174144 | 0.296277 |
| S | 0.483695 | 0.686004 | 0.279036 |
| S | 0.982374 | 0.186294 | 0.282108 |
| S | 0.976449 | 0.683875 | 0.295308 |
| S | 0.407637 | 0.174605 | 0.521423 |
| S | 0.411667 | 0.664932 | 0.48146 |
| S | 0.907576 | 0.16871 | 0.479256 |
| S | 0.905712 | 0.668107 | 0.500881 |
| S | 0.222676 | 0.508343 | 0.242144 |
| S | 0.205801 | 0.009509 | 0.229097 |
| S | 0.705589 | 0.509079 | 0.220154 |
| S | 0.702461 | 0.020249 | 0.213867 |
| S | 0.164853 | 0.190877 | 0.941255 |
| S | 0.171315 | 0.693706 | 0.942827 |
| S | 0.673091 | 0.200652 | 0.915693 |
| S | 0.667547 | 0.693004 | 0.938475 |
| S | 0.42416 | 0.452425 | 0.384994 |
| S | 0.405679 | 0.95092 | 0.419736 |
| S | 0.906508 | 0.452573 | 0.420941 |
| S | 0.906077 | 0.955004 | 0.419846 |
| S | 0.05678 | 0.120927 | 0.939859 |
| S | 0.064944 | 0.62317 | 0.958214 |
| S | 0.549693 | 0.177514 | 0.944517 |
| S | 0.560038 | 0.621876 | 0.93463 |
| S | 0.289149 | 0.985095 | 0.770226 |
| S | 0.291318 | 0.488806 | 0.759671 |
| S | 0.794616 | 0.990719 | 0.769668 |
| S | 0.796583 | 0.489852 | 0.76926 |
| S | 0.017841 | 0.313529 | 0.717006 |
| S | 0.017182 | 0.814489 | 0.722359 |
| S | 0.518335 | 0.813182 | 0.713796 |
| S | 0.369464 | 0.364089 | 0.556065 |
| S | 0.319504 | 0.858929 | 0.456604 |
| S | 0.819081 | 0.360924 | 0.450359 |
| S | 0.816629 | 0.8662 | 0.45653 |
| S | 0.089721 | 0.045743 | 0.57843 |
| S | 0.088779 | 0.544774 | 0.592756 |
| S | 0.587738 | 0.045402 | 0.593613 |
| S | 0.597736 | 0.548723 | 0.570151 |
| S | 0.434336 | 0.362871 | 0.031687 |
| S | 0.438836 | 0.875891 | 0.056236 |
| S | 0.94528 | 0.37946 | 0.061733 |
| S | 0.937272 | 0.874502 | 0.062677 |
| S | 0.322224 | 0.304492 | 0.066689 |
| S | 0.332279 | 0.804199 | 0.060214 |
| S | 0.837531 | 0.308226 | 0.052387 |

| | | | |
|---|---|---|---|
| S | 0.827958 | 0.807051 | 0.066303 |
| S | 0.162547 | 0.427839 | 0.059473 |
| S | 0.152632 | 0.925988 | 0.048898 |
| S | 0.656053 | 0.427059 | 0.033738 |
| S | 0.652873 | 0.934172 | 0.037738 |
| S | 0.177914 | 0.135965 | 0.543352 |
| S | 0.174222 | 0.635637 | 0.54276 |
| S | 0.672309 | 0.136015 | 0.523841 |
| S | 0.684227 | 0.641247 | 0.541699 |
| S | 0.34262 | 0.068508 | 0.950579 |
| S | 0.347658 | 0.572893 | 0.936643 |
| S | 0.847841 | 0.073902 | 0.950668 |
| S | 0.847245 | 0.572458 | 0.953793 |

**S-10: Table 4** *Cell vectors (a, b, and c) in Å and atomic positions in fractional coordinates for Ni:$VS_4$ computed with PBE*

| | *x* | *y* | *c* |
|---|---|---|---|
| *a* | 16.14472 | 0 | 0 |
| *b* | -2.10279 | 16.0072 | 0 |
| *c* | -1.80678 | 1.584954 | 6.877967 |
| V | 0.308049 | 0.441969 | 0.117499 |
| V | 0.308049 | 0.941969 | 0.117499 |
| V | 0.808049 | 0.441969 | 0.117499 |
| V | 0.808049 | 0.941969 | 0.117499 |
| V | 0.191951 | 0.058031 | 0.882501 |
| V | 0.191951 | 0.558031 | 0.882501 |
| V | 0.691951 | 0.058031 | 0.882501 |
| V | 0.691951 | 0.558031 | 0.882501 |
| V | 0.441969 | 0.808049 | 0.382501 |
| V | 0.941969 | 0.308049 | 0.382501 |
| V | 0.941969 | 0.808049 | 0.382501 |
| V | 0.058031 | 0.191951 | 0.617499 |
| V | 0.058031 | 0.691951 | 0.617499 |
| V | 0.558031 | 0.191951 | 0.617499 |
| V | 0.558031 | 0.691951 | 0.617499 |
| V | 0.08565 | 0.342714 | 0.540307 |
| S | 0.08565 | 0.842714 | 0.540307 |
| S | 0.58565 | 0.342714 | 0.540307 |
| S | 0.58565 | 0.842714 | 0.540307 |
| S | 0.496445 | 0.201743 | 0.27957 |
| S | 0.496445 | 0.701743 | 0.27957 |
| S | 0.996445 | 0.201743 | 0.27957 |
| S | 0.996445 | 0.701743 | 0.27957 |
| S | 0.41435 | 0.157286 | 0.459693 |
| S | 0.41435 | 0.657286 | 0.459693 |
| S | 0.91435 | 0.157286 | 0.459693 |
| S | 0.91435 | 0.657286 | 0.459693 |
| S | 0.201743 | 0.496445 | 0.22043 |

| | | | |
|---|---|---|---|
| S | 0.201743 | 0.996445 | 0.22043 |
| S | 0.701743 | 0.496445 | 0.22043 |
| S | 0.701743 | 0.996445 | 0.22043 |
| S | 0.157259 | 0.187011 | 0.942534 |
| S | 0.157259 | 0.687011 | 0.942534 |
| S | 0.657259 | 0.187011 | 0.942534 |
| S | 0.657259 | 0.687011 | 0.942534 |
| S | 0.398659 | 0.446 | 0.42802 |
| S | 0.398659 | 0.946 | 0.42802 |
| S | 0.898659 | 0.446 | 0.42802 |
| S | 0.898659 | 0.946 | 0.42802 |
| S | 0.054 | 0.101341 | 0.92802 |
| S | 0.054 | 0.601341 | 0.92802 |
| S | 0.554 | 0.101341 | 0.92802 |
| S | 0.554 | 0.601341 | 0.92802 |
| S | 0.298257 | 0.003555 | 0.77957 |
| S | 0.298257 | 0.503555 | 0.77957 |
| S | 0.798257 | 0.003555 | 0.77957 |
| S | 0.798257 | 0.503555 | 0.77957 |
| S | 0.003555 | 0.298257 | 0.72043 |
| S | 0.003555 | 0.798257 | 0.72043 |
| S | 0.503555 | 0.298257 | 0.72043 |
| S | 0.503555 | 0.798257 | 0.72043 |
| S | 0.312989 | 0.342741 | 0.442534 |
| S | 0.312989 | 0.842741 | 0.442534 |
| S | 0.812989 | 0.342741 | 0.442534 |
| S | 0.812989 | 0.842741 | 0.442534 |
| S | 0.101341 | 0.054 | 0.57198 |
| S | 0.101341 | 0.554 | 0.57198 |
| S | 0.601341 | 0.054 | 0.57198 |
| S | 0.601341 | 0.554 | 0.57198 |
| S | 0.446 | 0.398659 | 0.07198 |
| S | 0.446 | 0.898659 | 0.07198 |
| S | 0.946 | 0.398659 | 0.07198 |
| S | 0.946 | 0.898659 | 0.07198 |
| S | 0.342741 | 0.312989 | 0.057466 |
| S | 0.342741 | 0.812989 | 0.057466 |
| S | 0.842741 | 0.312989 | 0.057466 |
| S | 0.842741 | 0.812989 | 0.057466 |
| S | 0.157286 | 0.41435 | 0.040307 |
| S | 0.157286 | 0.91435 | 0.040307 |
| S | 0.657286 | 0.41435 | 0.040307 |
| S | 0.657286 | 0.91435 | 0.040307 |
| S | 0.187011 | 0.157259 | 0.557466 |
| S | 0.187011 | 0.657259 | 0.557466 |
| S | 0.687011 | 0.157259 | 0.557466 |
| S | 0.687011 | 0.657259 | 0.557466 |
| S | 0.342714 | 0.08565 | 0.959693 |
| S | 0.342714 | 0.58565 | 0.959693 |

| | | | |
|---|---|---|---|
| S | 0.842714 | 0.08565 | 0.959693 |
| S | 0.842714 | 0.58565 | 0.959693 |
| Ni | 0.441969 | 0.308049 | 0.382501 |

**S-11: Table 5** *Cell vectors (a, b, and c) in Å and atomic positions in fractional coordinates for Ni-$V_S$:$VS_4$ computed with PBE*

| | *x* | *y* | *c* |
|---|---|---|---|
| *a* | 16.3299 | 0.686925 | 0.569497 |
| *b* | -1.44217 | 15.86756 | -0.03641 |
| *c* | -1.51499 | 1.521082 | 6.840019 |
| V | 0.304973 | 0.44261 | 0.072274 |
| V | 0.305772 | 0.942988 | 0.122552 |
| V | 0.804574 | 0.440719 | 0.113376 |
| V | 0.811095 | 0.936845 | 0.13455 |
| V | 0.193154 | 0.060506 | 0.881278 |
| V | 0.189728 | 0.559041 | 0.864308 |
| V | 0.690733 | 0.057433 | 0.890599 |
| V | 0.688652 | 0.555251 | 0.876418 |
| V | 0.437291 | 0.805982 | 0.38646 |
| V | 0.939999 | 0.307395 | 0.379897 |
| V | 0.939077 | 0.806368 | 0.386791 |
| V | 0.061117 | 0.195641 | 0.612943 |
| V | 0.058569 | 0.68894 | 0.6174 |
| V | 0.570399 | 0.177123 | 0.646514 |
| V | 0.554892 | 0.690234 | 0.615609 |
| V | 0.067845 | 0.348072 | 0.553396 |
| S | 0.069629 | 0.841811 | 0.560684 |
| S | 0.597098 | 0.331458 | 0.580025 |
| S | 0.565699 | 0.842397 | 0.565006 |
| S | 0.49885 | 0.2121 | 0.322597 |
| S | 0.511903 | 0.709684 | 0.271375 |
| S | 0.017363 | 0.211999 | 0.268579 |
| S | 0.012365 | 0.707763 | 0.273931 |
| S | 0.439042 | 0.125503 | 0.504907 |
| S | 0.426601 | 0.653691 | 0.437865 |
| S | 0.933447 | 0.154844 | 0.438266 |
| S | 0.928085 | 0.653302 | 0.444618 |
| S | 0.185785 | 0.472484 | 0.191895 |
| S | 0.17823 | 0.980193 | 0.202497 |
| S | 0.678503 | 0.476665 | 0.199104 |
| S | 0.685808 | 0.975961 | 0.216465 |
| S | 0.134469 | 0.179842 | 0.958695 |
| S | 0.134054 | 0.674671 | 0.959988 |
| S | 0.637352 | 0.17544 | 0.983479 |
| S | 0.62985 | 0.673096 | 0.958462 |
| S | 0.367625 | 0.937479 | 0.451711 |
| S | 0.868224 | 0.437855 | 0.440135 |
| S | 0.874011 | 0.9357 | 0.456347 |

| | | | |
|---|---|---|---|
| S | 0.045678 | 0.092543 | 0.89901 |
| S | 0.044496 | 0.587226 | 0.90423 |
| S | 0.54966 | 0.085051 | 0.934382 |
| S | 0.541039 | 0.585392 | 0.901955 |
| S | 0.319928 | 0.022067 | 0.803263 |
| S | 0.318252 | 0.530219 | 0.768256 |
| S | 0.818558 | 0.016337 | 0.81191 |
| S | 0.815405 | 0.519636 | 0.78993 |
| S | 0.983737 | 0.291465 | 0.722951 |
| S | 0.985062 | 0.787348 | 0.730392 |
| S | 0.49419 | 0.29351 | 0.702805 |
| S | 0.480075 | 0.786539 | 0.731051 |
| S | 0.365001 | 0.42355 | 0.395668 |
| S | 0.299218 | 0.829436 | 0.426254 |
| S | 0.801454 | 0.328931 | 0.422272 |
| S | 0.803687 | 0.82787 | 0.442323 |
| S | 0.134626 | 0.067803 | 0.54995 |
| S | 0.125369 | 0.560868 | 0.540859 |
| S | 0.631091 | 0.053942 | 0.567027 |
| S | 0.624575 | 0.559768 | 0.549044 |
| S | 0.441255 | 0.396257 | 0.074228 |
| S | 0.453023 | 0.909681 | 0.100887 |
| S | 0.952279 | 0.409595 | 0.089301 |
| S | 0.955919 | 0.906841 | 0.097905 |
| S | 0.342545 | 0.325108 | 0.971004 |
| S | 0.363135 | 0.823457 | 0.042266 |
| S | 0.863851 | 0.320853 | 0.037862 |
| S | 0.865248 | 0.819654 | 0.047559 |
| S | 0.165214 | 0.40937 | 0.971158 |
| S | 0.167509 | 0.911494 | 0.992004 |
| S | 0.665655 | 0.406197 | 0.991821 |
| S | 0.670158 | 0.905928 | 0.009203 |
| S | 0.201045 | 0.175991 | 0.576961 |
| S | 0.192591 | 0.669941 | 0.559531 |
| S | 0.702422 | 0.160922 | 0.584405 |
| S | 0.692277 | 0.667865 | 0.570248 |
| S | 0.331577 | 0.09181 | 0.011419 |
| S | 0.327882 | 0.595122 | 0.984435 |
| S | 0.832469 | 0.087655 | 0.016538 |
| S | 0.827303 | 0.589885 | 0.997469 |
| Ni | 0.462557 | 0.339869 | 0.383301 |

**References**

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