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**Table 1:** Electronic spectral bands and bonding parameters of  $[\text{MoO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2+}[\text{NH}_4]^{2+}$  Compound

| Complex                            | Band (cm-1)  | S'L' J' | Spectral Parameter               |
|------------------------------------|--------------|---------|----------------------------------|
| Pr - Mo                            | 20000        | $^3P_0$ | $\beta=0.7908$ 9 More covalence) |
|                                    | 21276        | $^3P_1$ | $b^{1/2}=0.3324$                 |
|                                    | 22471        | $^3P_2$ | $\delta\%=0.282$                 |
|                                    | 11488(880nm) |         | $\eta=0.0016$                    |
| Due to H- bonding                  |              |         |                                  |
| Ground state of Pr(III) is $^3H_4$ |              |         |                                  |

**Table 2: XRD** Pattern of thin film of  $\text{MoO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})^{2+}[\text{NH}_4]^{2+}$  Compound

| $\theta$ | $\text{Sin } \theta$ | $\text{Sin}^2 \theta$ | $d (\text{Å})$ | $I/I_0$ | (h k l)                  |
|----------|----------------------|-----------------------|----------------|---------|--------------------------|
| 0.0045   | 0.13925              | 0.01939               | 5.5316         | 50.0    |                          |
| 9.2355   | 0.16049              | 0.025725              | 4.7994         | 100.0   |                          |
| 9.4365   | 0.16395              | 0.02688               | 4.6981         | 87.5    |                          |
| 9.6025   | 0.16681              | 0.02826               | 4.6177         | 75.0    |                          |
| 10.9295  | 0.18960              | 0.03594               | 4.0626         | 100.0   | (001,cubic), (100,tetra) |
| 11.8960  | 0.20613              | 0.04249               | 3.7368         | 62.5    | (002,hexa)               |
| 13.4020  | 0.23178              | 0.05372               | 3.3233         | 62.5    | (002,hexa)               |
| 13.8915  | 0.24008              | 0.05764               | 3.2084         | 100.0   | (002,hexa)               |
| 29.8040  | 0.49718              | 0.24719               | 1.5498         | 62.5    | (201,tetra)              |

XRD Pattern of thin film of  $[\text{WO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2+}[\text{NH}_4]^{2+}$  Compound is also hexagonal.

**Table 3:** IR Spectra of  $[\text{MO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2+}[\text{NH}_4]^{2+}$  [ M = Mo,W]

| Mo-Pr             | W-Pr                 | Assignment   |
|-------------------|----------------------|--|
| Red Brown Soln.   | Green Soln.          | $\nu\text{H}_2\text{O}$ sym broad, str H-O-H H <sub>2</sub> bond |
| 3640.17-2800 cm-1 | 3339.90 v broad cm-1 |  |
| 2134.88           | 2134.88 m, str       | $\nu$ SH   |
| 1940.43 cm-1      | 1940.43 M, str       | $\nu$ OH   |
| 1641.5            |                      | $\delta$ H <sub>2</sub> O  |
| 1645.86           |                      | ----   |
| 1125              |                      | Td sym   |
| 999               |                      |  |
| 930.940           |                      | $\nu$ Mo—O   |
| 864               |                      |  |
| 700               |                      |  |
| 495               |                      |  |
| 450               |                      | $\nu$ Ln-----O   |
| 485               |                      | $\nu$ Ln----S, Mo---S  |

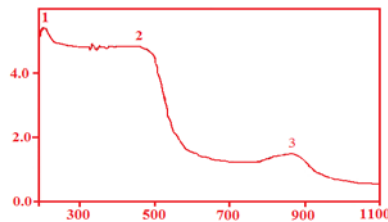


Figure-2a UV-Visible Spectrum of compound of  $[\text{MoO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2+}$

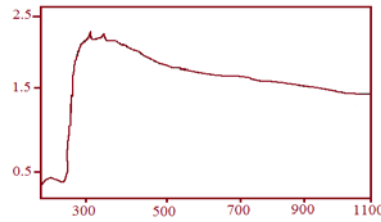


Figure-2b UV-Visible Spectrum of compound of  $[\text{MoO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2+}$  in  $\text{CCl}_4$

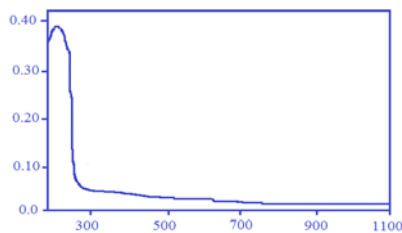


Figure-3a UV-Visible Spectrum of compound of  $[\text{WO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2+}$

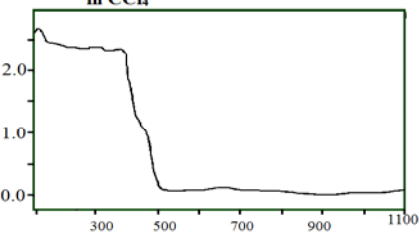


Figure-3b UV-Visible Spectrum of compound of  $[\text{WO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2+}$  in  $\text{CCl}_4$

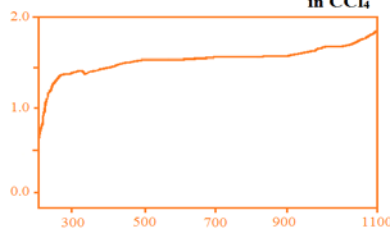


Figure- 4. UV-Visible Spectrum of  $\text{H}_2\text{O}$

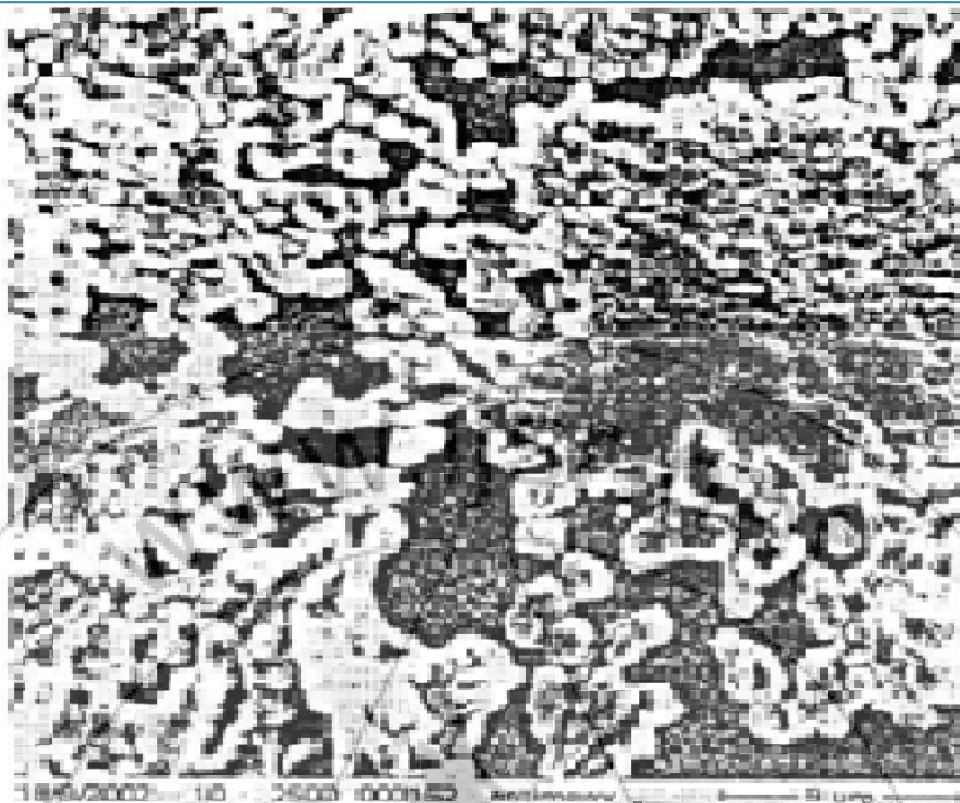


Figure-5. SEM of thin film of compound of  $[\text{MoO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2-}[\text{NH}_4]^{2+}$



Figure-6. TEM of thin film of compound of  $[\text{MoO}_2(\text{H}_2\text{O})_2\text{Pr}(\text{OH})_2(\text{SH})(\text{H}_2\text{O})]^{2-}[\text{NH}_4]^{2+}$