

Design and friction loss study of full-ocean depth oil-filled direct current motor

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Design of the Oil-filled Motor

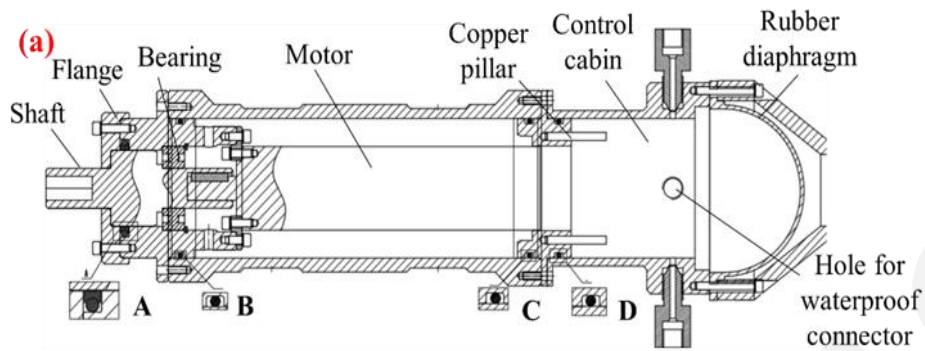


Fig. 1 Structure of the oil-filled motor: a) the detailed structure, b) a 3D model of the motor.

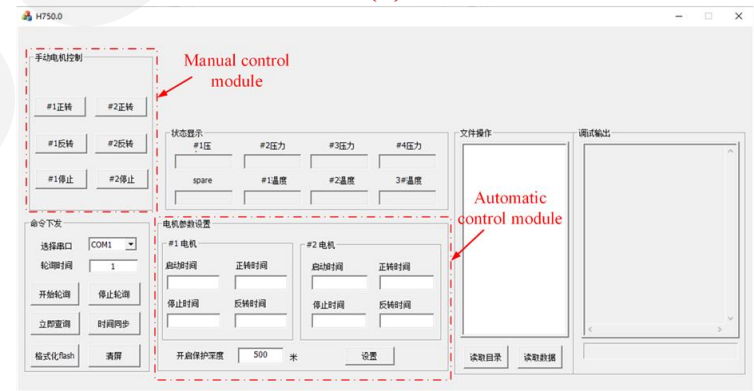
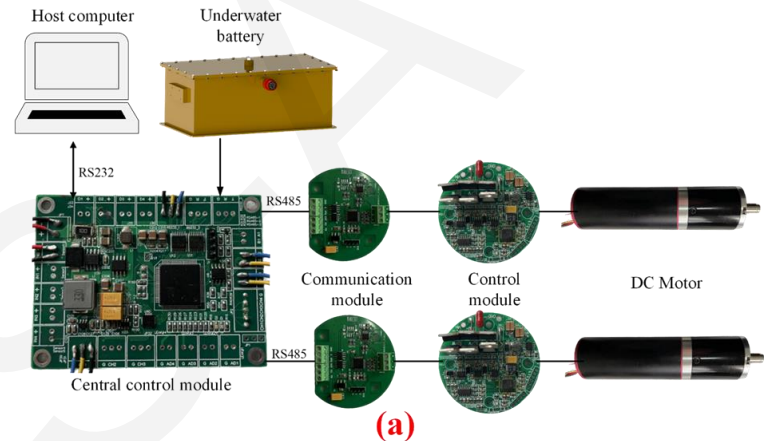


Fig. 2 Control and interface of the software: a) control system, b) interface of the software.

Study of the Rotary Seal

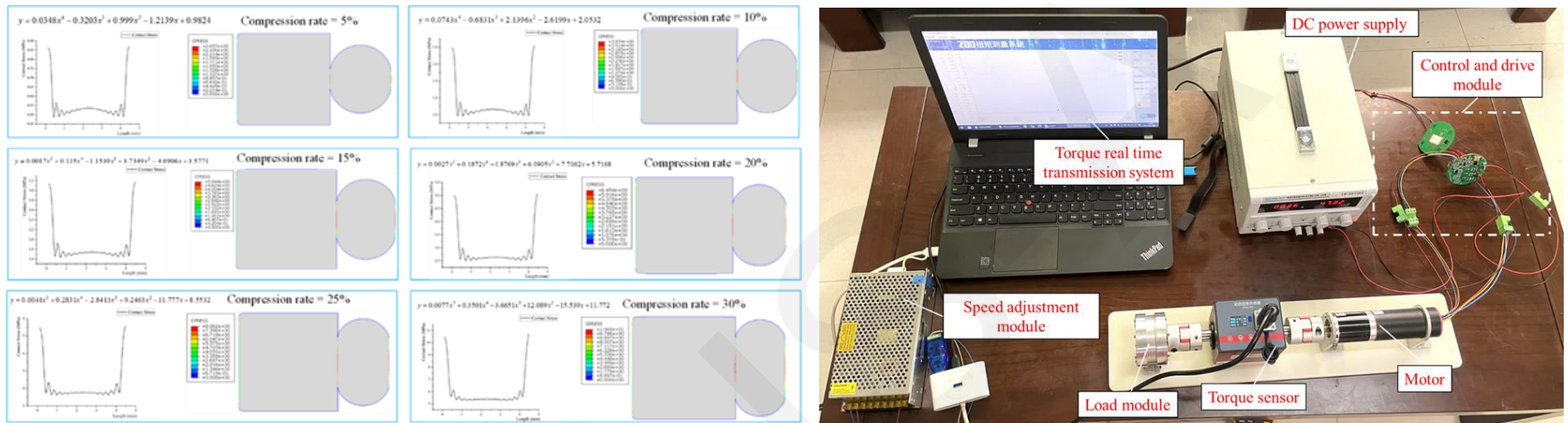


Fig. 3 & Fig. 5 Simulation and experiment study of the rotary seal of the oil-filled motor

Table 4 Torque test results

Compression rate	5%	10%	15%	20%	25%	30%
Start torque (Nm)	0.327	0.5608	1.151	2.6554	3.8046	5.4468
Stable torque (Nm)	0.18755	0.37752	0.62315	0.94501	1.35399	1.93842

Influence of the Oil

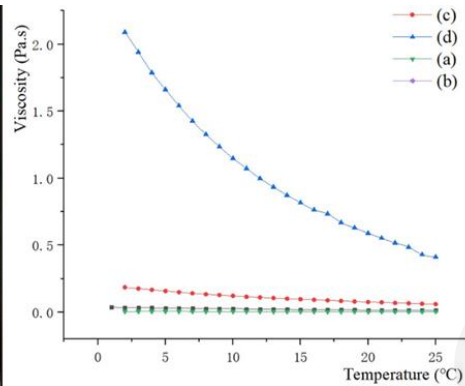
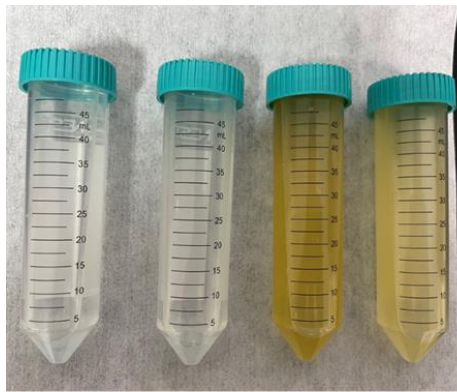


Fig. 6 Four types of oil were tested

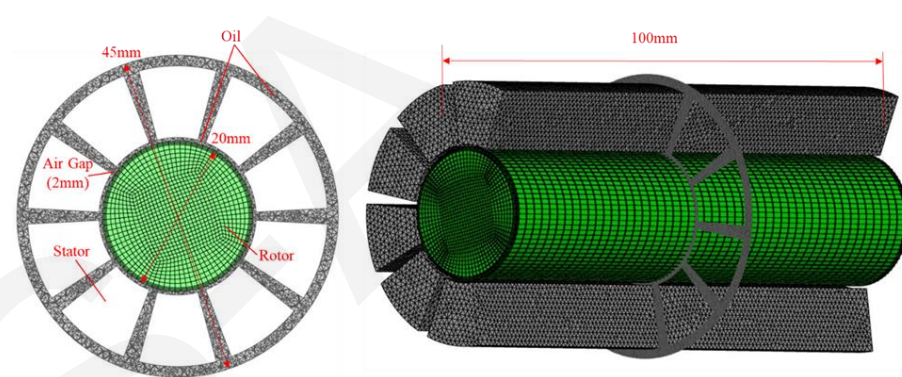


Fig. 7 The simulation model

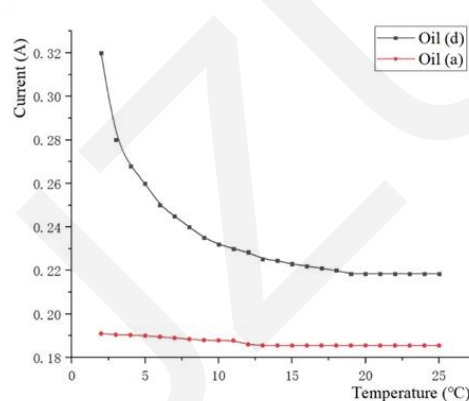
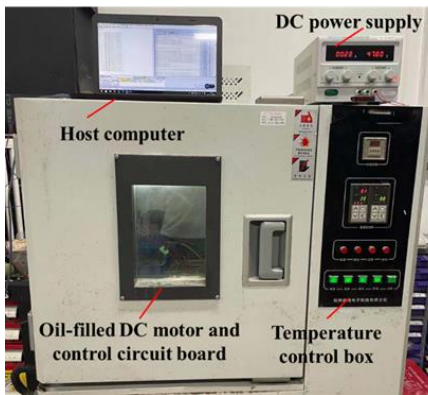


Fig. 9 Temperature test

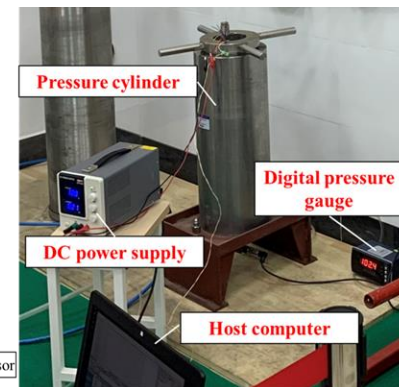
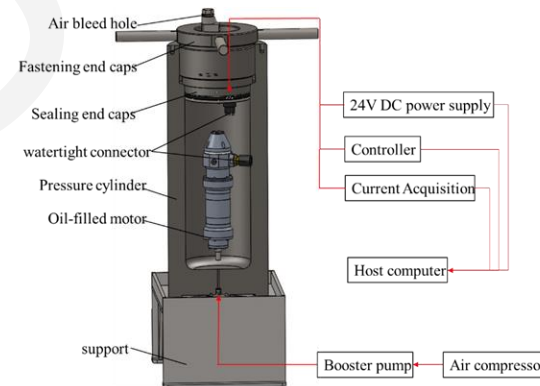


Fig. 10 High pressure test

60-MPa high-pressure chamber test

High Pressure chamber test conducted at Zhoushan campus of Zhejiang University

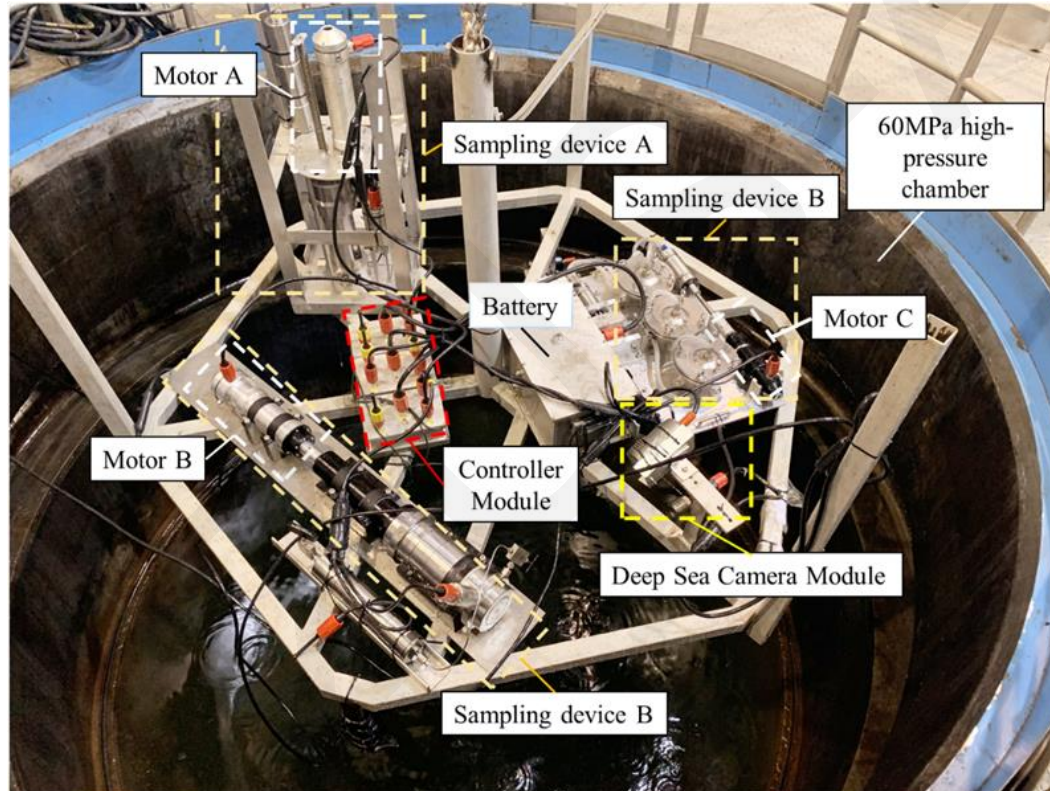


Fig. 11 60-MPa high-pressure chamber test

In-situ application and Conclusion

Multiple applications in the Marianas Trench have demonstrated that the motors can operate in the deepest extreme environments of the ocean.

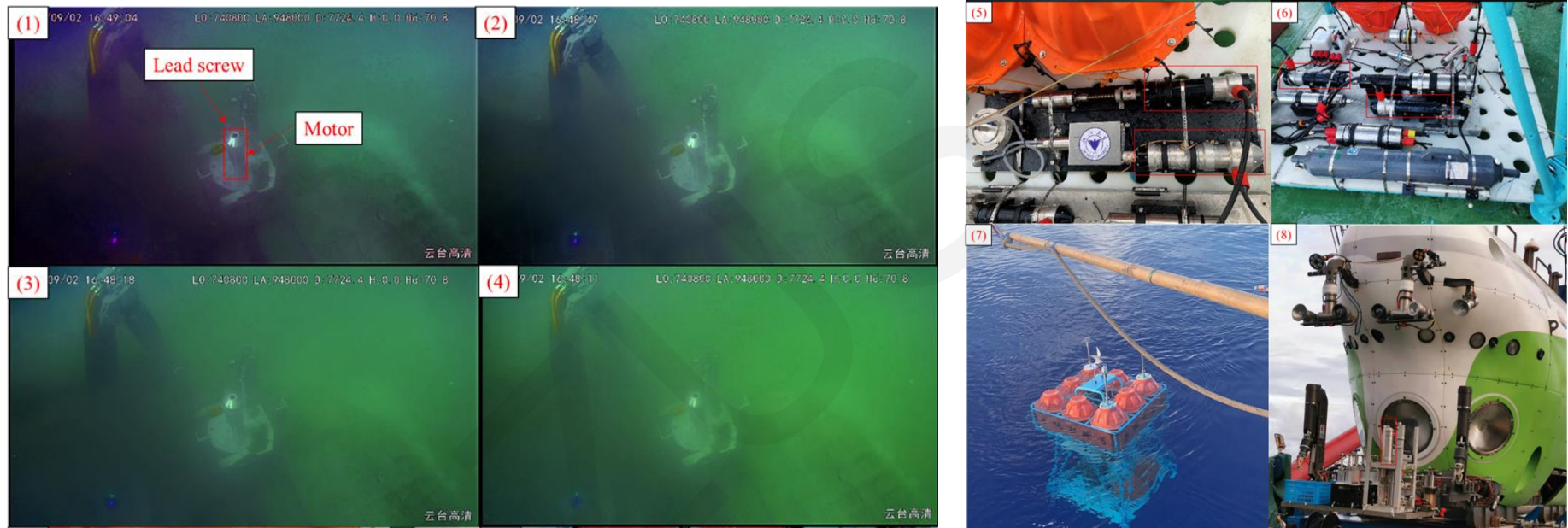


Fig. 14 In-situ application of the motor (1-4): The motor drives a sediment sampler at the bottom of the Mariana Trench to acquire samples. (5): The motor deployed on a filter device. (6): The motor deployed on a benthic capture device. (7): Mounted on the "Yuanweishiyanhao" lander for testing; (8): Mounted on the "Fendouzhe" manned submersible for testing.