

Development of internally heated gas pressure vessel for the research of magma genesis

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The knowledge of phase relations of minerals and rocks under high pressure - high temperature conditions are required as the fundamental information to resolving the magma genesis in the subduction zone. Internal heated gas pressure vessel, which uses inert gas for pressure transmitting medium and can generate pure hydrostatic condition, is suitable to investigate the details of phase relations of rocks under pressure - temperature conditions which corresponds to the Earth's crust. We newly installed internal gas pressure vessel in Tokyo Institute of Technology, and it can generate 850 MPa as the maximum pressure. In the case of this pressure vessel, high pressure is generated by gas compressor up to 200 MPa. At above 200 MPa, sample chamber is isolated from the gas compressing systems, and higher pressure condition is generated by compressing the volume of sample chamber by oil pressure system. Therefore, up to 200 MPa, gas pressure can be measured directly, but above 200 MPa, the pressure condition of sample chamber should be calculated from the loaded oil pressure by considering the effect of friction between piston and cylinder. Unfortunately, it is very difficult to estimate the effect of friction, because this friction largely changed with the history of increasing and decreasing pressure cycle. Actually, pressure value calculated from oil pressure can be compared with the directly measured gas pressure up to 200 MPa, and the difference between these pressure values amount to approximately 10%. In order to acquire more reliable pressure values, manganin string was inserted in the pressure chamber and pressure dependence of its electrical resistance was measured. The pressure dependence of electrical resistance was measured by the present gas pressure vessel up to 200 MPa, and it is also measured up to 500 MPa by using another gas pressure vessel. In these experiments, it was found that electrical resistance was lineally changed with gas pressure. The error of pressure value, which can be estimated from electrical resistance of manganin, is not excess 5 MPa. This error value is apparently smaller compared with the error of pressure value calculated from the applied oil pressure, which will be amounts to 100 MPa at the maximum pressure condition. However, it is also observed that the electrical resistance of manganin shows hysteresis, and further detailed investigation is required for more precise measurement of pressure value in the sample chamber. By using this internally heated gas pressure vessel, melting experiments of andesite and other rocks will be performed.