



Overall Objectives and Plans for the Project

■ Main Objective

Development of new knowledge on electrical insulating materials and insulation systems necessary for design and testing of reliable high voltage power equipment in harsh subsea environment.



Overall Objectives and Plans for the Project cont.

- Sub goals:
 - Characterization of proposed and new electrical insulating materials
 - Identification of failure mechanisms and long term ageing
 - Development of methods for testing and qualification of insulating materials and insulation systems
 - Development of methods for condition assessment
 - Recruitment and education of new specialists (Master and Doctoral students)



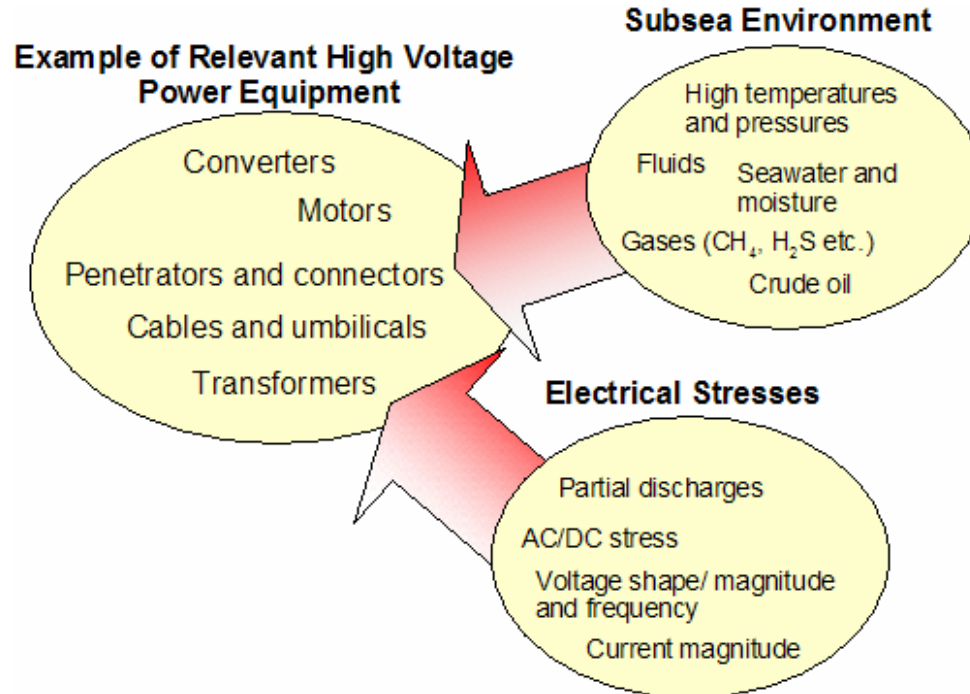
Overall Objectives and Plans for the Project cont.

■ Background

The high voltage technology used for subsea components are initially developed for land based systems or for low voltage subsea systems.

There is a big gap between technology need, and available technology as the components are taken into use at steady higher temperatures and voltage levels.

Overall Objectives and Plans for the Project cont.





Overall Objectives and Plans for the Project cont.

- The research within this Petromaks KMB project will have a generic approach in order to provide knowledge for technical improvements and consequently long and reliable service performance of high voltage subsea power equipment.

Overall Objectives and Plans for the Project cont.

- Four main research tasks are defined within the project:
 - T1: Development of New and Modification of Proposed Electrical Insulation Materials
 - T2: Identification of Failure Mechanisms
 - T3: Development of Methods for Testing and Qualification of Insulating Materials and Insulation Systems.
 - T4: Development of Equipment and Methods for Condition Assessment

- Recruitments
 - There will be one Ph D student working with some activities within Task T1 and T2. Another student will work with subjects within Task T4. The Ph D students will be affiliated at NTNU.

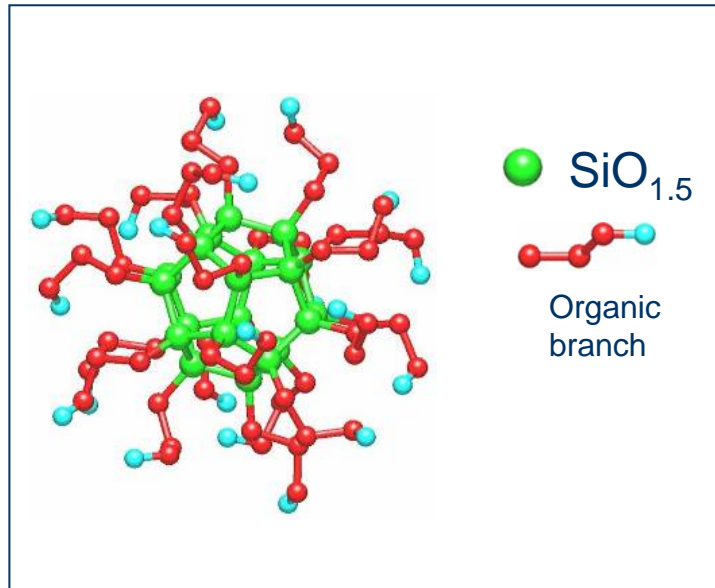


Overall Objectives and Plans for the Project cont.

- **T1: Development of New and Modifications of Proposed Electrical Insulation Materials**

- Task T1 will consists of four activities:
- T1.1: Survey actual and new electrical insulation materials and additives
- T1.2: Examine the possibilities to apply nanotechnology or other additives for the enhancement of the long term properties of electrical insulation materials
- T1.3: Manufacture and examine morphology and intrinsic properties of modified materials
- T1.4: Examine the possibilities to include barrier materials in electrical designs

Overall Objectives and Plans for the Project cont.



- PP Materials**
- Borealis (2)
 - Basell (2)
 - Atofina (1)
 - Dow (?)



Overall Objectives and Plans for the Project cont.

- **T2: Identification of Failure Mechanisms and Long Term Ageing**

- Task T2 will consist of three activities:
 - T2.1: Materials and test objects
 - T2.2: Material ageing
 - T2.3: Characterization of materials



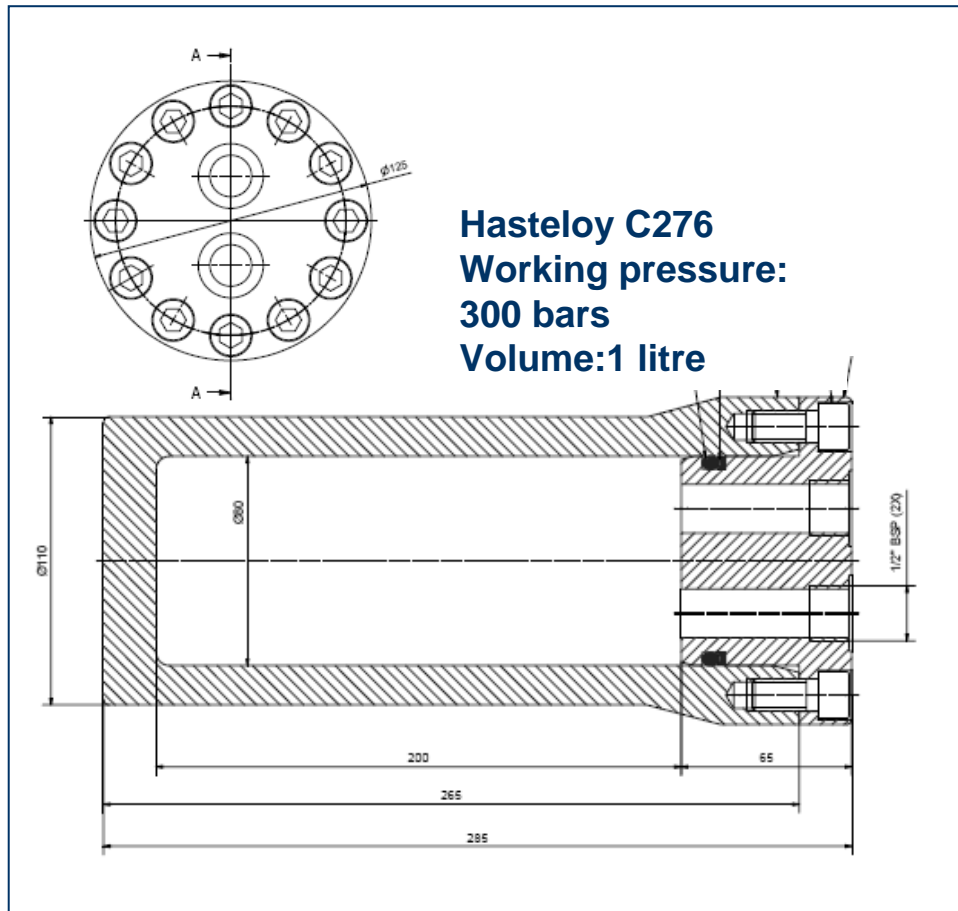
Overall Objectives and Plans for the Project cont.

- **T3: Development of Methods for Testing and Qualification of Insulating Materials and Insulation Systems.**

- Task 3 will consist of three activities:
 - T3.1: Establish necessary high pressure vessels for Tasks T1, T2 and T3
 - T3.2: Propose and verify qualification tests for reliable subsea electric power materials and equipment based on findings of Task T2
 - T3.3: Establish necessary equipment for condition monitoring of Task T4



Overall Objectives and Plans for the Project cont.





Overall Objectives and Plans for the Project cont.

- **T4: Development of Equipment and Methods for Condition Assessment**

- Task T4 will consist of three activities:
 - T4.1: Survey of candidate methods
 - T4.2: Development of new or modified methods
 - T4.3: Testing and applicability of selected methods



Overall Objectives and Plans for the Project cont.

■ Progress plan

Tasks	2006	2007	2008	2009	2010	2011
T1. Proposed and new electrical insulating materials						
T2. Long term ageing and failure mechanisms						
T3. Equipment and methods for testing and qualification						
T4. Methods for condition assessment						
Ph D students MSc students ¹⁾						

¹⁾ Master students will be included in some of the tasks from 2006/2007. Ph D work is planned to start in 2008, where several Master works will simultaneously be accomplished.