1. Aims of the Thesis

The goal of the Thesis is the preparation of various morphologies produced by conducting polymers, viz. polyaniline (PANI), the control of conductivity, and the understanding of the chemistry of aniline oxidation. In these studies, three different directions have been developed. The first part of the Thesis is focused on the synthesis of PANI. The optimum conditions for preparation of all forms available: powders, thin films, and colloidal dispersions with respect to the morphology, yield, and conductivity have been described. A systematic study of PANI protonated with phosphoric acid as well as a comparative study of the preparation of PANI and polypyrrole (PPy) have been made. The oxidation of aniline with noble-metals compounds, such as silver nitrate, the effect of the medium acidity, concentration of reactants and the possible effect of daylight have been investigated.

A new approach for the synthesis of PANI with separated reactants, aniline and an oxidant, is described in the second part of the Thesis. Various studies have been presented here to investigate the mechanisms of such reactions. The concept of coupled PANI-assisted redox reaction by means of transport of electrons and protons through conducting PANI membrane has been demonstrated. A possible electron–ion-coupled transport mechanism was proposed. The principle of separated reactants has been applied to explain the polymerization on membranes, in gelatin gels, and in modifying polystyrene (PS) latex with PANI.

The third part of this Thesis involves the studies on properties of PANI, which are required for potential applications, such as the thermal and chemical stability, high conductivity, *etc.* The stability of colloidal dispersion would be of primary interest for anticorrosion additives in liquid media in the heating systems or in the cooling liquids in engines. Specific values of the conductivity as well as water contact angles are of importance for the studies, such as electrorheology, electrocatalysis and can be used for surface modification with conducting polymers. The conductivity has been efficiently controlled by partial protonation of the PANI base. In another study, the feasibility of making a sensor for iodine based on the reaction of PANI with iodine has also been demonstrated. Since many applications of PANI use this polymer in aqueous solutions, the effect of an acidic aqueous medium on the conductivity of thin *in-situ*-polymerized PANI films has been illustrated. Thus, mixed electron and proton conductivity has been studied.