Blended Membranes for Energy Recovery Ventilation (ERV) Systems

Abstract

In buildings it is generally desirable to provide an exchange of air such that air from inside the building is expelled and replaced with fresh air from outside the building. In colder climates where the inside is much warmer than the outside air (“heating applications”) or in hot climates where the inside is air-conditioned and is much cooler than the outside air (“cooling applications”) there is an energy cost to this. In heating applications, the fresh air is typically both colder and drier than the air inside the building. Energy is required to heat and humidity the fresh air. In cooling applications, the fresh air is typically both warmer and moister than the air inside the building. Energy is required to cool and dehumidify the fresh air. The amount of energy required for heating and cooling applications can be reduced by transferring heat and moisture between the outgoing air and the incoming air. This may be done using an ERV system comprising membranes, which separate flow flows and outgoing air.

Some membranes which are composed of different polymers (polymer blends) can fulfill EVR- requirements. From a scientific point of view, only few polymers are suitable to generate a membrane with the corresponding chemical properties and pore sizes which induce perfect water vapor transfer and stability overall.

The thesis should focus on the development of suitable EVR membranes. This is to be accomplished via the blending a sulfonated PEEK and a cellulose acetate. Starting from PEEK sulfonation and characterization of the sulfonated product, the work should deal in a second step with the preparation of several acetone soluble polymer mixtures and their manufacture with respect to membrane formation via coagulation processes. Finally, the produced membranes have to be characterized according to pore structure formation (SEM), water vapor permeability, the thermal and caloric behavior, and other important parameters.