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Mechanical characterization of the elastoplastic response of asphalt felt paper

Claudio A. Bustos[a], Claudio M. García–Herrera[a]*, Diego J. Celentano[b], Diego A. Vasco[a]

a: Departamento de Ingeniería Mecánica, Universidad de Santiago de Chile, USACH, Av. Bernardo O'Higgins 3363, Santiago de Chile, Chile
b: Departamento de Ingeniería Mecánica y Metalúrgica, Pontificia Universidad Católica de Chile, PUC, Av. Vicuña Mackenna 4860, Santiago de Chile, Chile

Abstract

A numerical and experimental analysis of the mechanical response of asphalt felt paper is presented. This material is widely used as a moisture barrier in buildings made of light materials. To ensure such function, it is necessary for this material not to be torn during its installation and operation and, for this reason, it is important to know its mechanical behavior in detail. To that end, tensile and bulge tests were carried out and respectively used to characterize the in-plane and out-of-plane rate-independent elastoplastic material responses which were observed to be strongly dependent on the directions of the cellulose fibers. The constitutive model considers the anisotropic character of the material assuming the Hill-48 function to define both the yield surface and the non-associated plastic flow rule to properly predict the mechanical behavior for the full deformation ranges of both tests. The procedure to fit the material parameters is carried out via a proposed iterative numerical-experimental methodology. The obtained results are found to adequately describe the material response in both the tensile and bulge tests.

Keywords: Paper; Paperboard; Plasticity; Anisotropy; Mechanical characterization.

1 INTRODUCTION

Asphalt felt paper (asphalt saturated kraft paper or building paper) was manufactured for the first time in the 1950s, and it is extensively used at present due to its unique qualities. Its main function is to provide a protective layer that resists outdoor conditions (i.e., as weather

*Corresponding author: claudio.garcia@usach.cl