Polyoxymethylene

Subjects: Dentistry, Oral Surgery & Medicine

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Polyoxymethylene (POM) is a material able to provide tooth-colored esthetics and that is suitable for fabrication of frameworks for removable dental prostheses. POM can be characterized as both polyethers (-C-O-) as well as polyacetals (-O-C-O-).

Keywords: tooth wear ; bruxism ; dental restoration wear ; resin ; synthetic ; implant-supported removable partial dentures

1. Introduction

Polyoxymethylene (POM) is a material able to provide tooth-colored esthetics and that is suitable for fabrication of frameworks for removable dental prostheses (RDPs). POM can be characterized as both polyethers (-C-O-) as well as polyacetals (-O-C-O-) [1]. Two formulations of POM are available: the polyoxymethylen homopolymer (POM-H) and copolymer (POM-C). POM-H can be fabricated either from formaldehyde monomers or from trioxane monomers [1]. POM-H is a highly crystalline thermoplastic material with a helical structure [1][2]. For the formulation of POM-C, small amounts of other cyclic ethers (-C-O-) featuring additional methylene groups are added (Figure 1) [3][4]. The additional methylene groups result in higher thermal and hydrolytic stability, which improves its resistancy against polymer chain degradation [5].

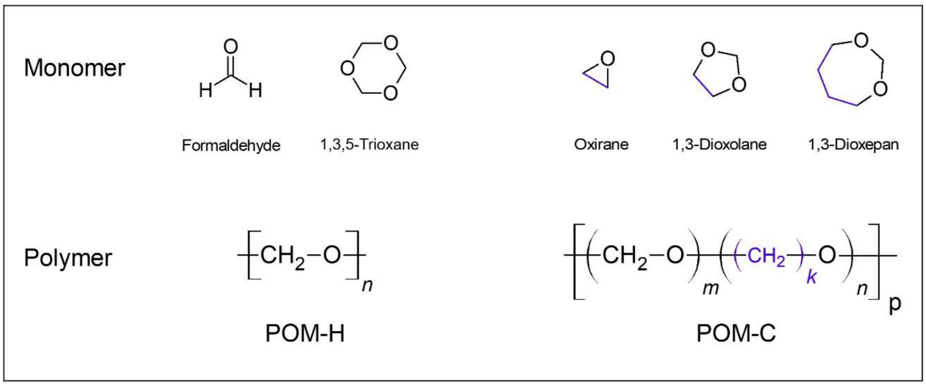

Figure 1. Structural formulas of POM-H, POM-C, and corresponding monomers, additional methylene groups (blue).

2. Application

Due to its excellent properties, POM is industrially used as a constructional material, e.g., for the manufacturing of gear wheels, housing parts, and bearings [2][5]. The favorable mechanical properties include high strength, stiffness, hardness, impact strength, low coefficient of friction, high wear resistance, and dimensional stability [2][5][6]. In addition, POM is featured by high chemical resistance, low water absorption, und high biocompatibility [7][8]. The melting point of POM ranges around 175 °C. For thermoplastic manufacturing techniques, injection moulding is the most frequently employed process [8]. By using subtractive manufacturing, artefacts due to smearing can arise due to excessive cutting temperature levels [9]. Additive manufacturing methods such as powder bed fusion have rarely been investigated [6]. Recent literature revealed that POM can also be processed via selective laser sintering [7]. Regarding the optical appearance, POM is characterized by even surfaces and an intrinsic whiteness. The latter is based on its crystallinity [6][7]; however, POM can also be colored [10]. All in all, favorable properties of POM are advantageous for medical application [3][7] and the CAD/CAM-techniques pave the way for application in dentistry (overview see Table 1).

Table 1. Advantages and Disadvantages of polyoxymethylene as material for removable dentures.

Advantages	Disadvantages
Tooth-colored, available in different shades	**Opaque**

Advantages	Disadvantages
Break-proof due to high impact strength	**Flexible**
Smooth surface	**Low chemical interaction with other materials**
Non known allergies	**Limited wear resistance**
Color stability	
Customizable color	

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