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Study on Elastic Distribution of Different Functional Regions of Bra Mold Cup ⋆

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Abstract

This paper explores the elastic coefficient of sponge material in different functional areas and functional zones of the bra mold cup to improve the accuracy of parameter setting in the finite element modeling of the bra mold cup, reduce the error of simulation experiment results, and provide more theoretical basis and data reference for functional research direction in the design and production process of the bra mold cup. In this paper, three converging bra mold cups of the same style and size are selected as samples, and the mold cups are divided into three measuring areas according to functional zones. Eight measuring points are selected, and micrometer and air bag contact pressure measuring system are used to measure the wearing pressure of each measuring point and the corresponding pressure of each measuring point when compressed every 0.2 mm. Excel software was used for linear fitting of data to obtain the range of elastic coefficients and elastic distribution of different functional regions of the bra cup. At the same time, this method can also be used to analyze the wearing pressure and elastic distribution of other types of bra mold cups, providing more research reference direction and technical basis for the design and production of bra molds cups.

Keywords: Mold Cup Bra; Functional Partition; Dress Pressure; Elastic Distribution

1 Introduction

In recent years, among bra products, mold cup bra is gradually favored by the public for its smooth and seamless inner surface of the cup, which provides good wearing comfort. At the

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same time, its unique molding technology improves the production efficiency of mold cup bra and reduces the traditional sewing cost, thus becoming the most favored product among consumers and underwear enterprises [1,2]. Because the bra mold cup is comfortable and close, smooth and straight surface avoids the skin damage caused by the seams between fabrics, and plays a better role in shaping and supporting the breasts, the mold cup becomes the most important part in all the details of the whole bra [3,4]. Although some progress and achievements have been made in the research of the bra cup at home and abroad, most of the research is limited to the digital simulation fitting and pressure distribution of the bra cup, and the division of different functional areas and the elastic distribution of the bra cup are still unclear. The division of different functional areas of the mold cup is to provide a foothold for the modeling and design of the mold cup. At the same time, the study of elastic distribution of mold cup is to provide data and technical reference for the design and production of mold cup and the setting of parameters of finite element simulation.

Wang YP, Chi L, etc. made an objective description of the pressure size and distribution of women's corsets under the condition of daily dressing [5,6]. The biomechanical model of the three-dimensional female human body developed by Yi L et al. can simulate the interaction between the bra and the breast as well as the pressure generated by the bra when a woman is wearing a bra [7]. By dividing the two-dimensional bra template into different functional areas, Lin Mu et al. can generate breast movement posture on the virtual model [8]. The above research only involves the pressure distribution and template area division of the bra, while the research on the functional zoning and elastic distribution of the mold cup is still unclear, and the research results have limitations for the reference direction of the design and production of the mold cup.

Chang-Lin Zhu et al. established a simulation model using finite element method to simulate women wearing typical compressed sports bras and obtained dynamic pressure changes during the wearing of sports bras. However, when it comes to the material of sports bra cups, the material parameters of sports bras are set only by obtaining the elastic modulus and Poisson's ratio of the fabric through stretching experiments [9]. Sun Y, Xu YY, etc. used finite element analysis software to establish a finite element fitting model suitable for analysis, and completed the digital simulation of the fitting between the mold cup and the upper body of the human body [10,11]. However, the parameters of the mold cup material in the study are set to the traditional definition on the physical properties of the mold cup sponge, which is quite different from reality. The mold cup is made of a polyurethane sponge and patch. The elastic deformation capacity of the mold cup is also different depending on the sponge density, type of patch, and manufacturing process [12]. In the finite element simulation experiment of wearing the bra mold cup, the physical properties that are not completely close to the actual mold cup will lead to a large error between the simulation result and the reality, which will affect the research results. Therefore, it is particularly necessary to carry out functional zoning of the bra mold cup and study the elastic coefficient of each zone.

Therefore, this paper will analyze the elastic distribution of each functional area of the bra mold cup through the wearing pressure and elastic compression test, and obtain the range of elastic coefficient of each measurement area.