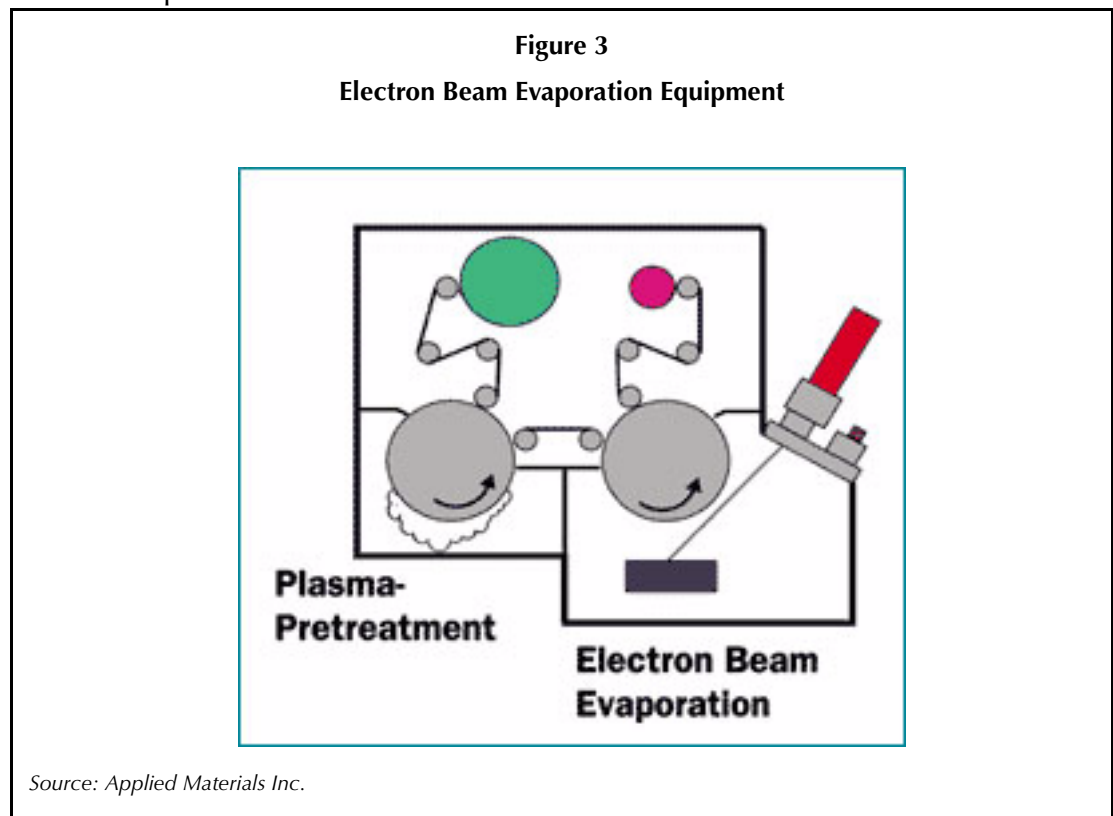


Electron beam evaporation

EB evaporation utilizes a beam of electrons, which strike the source material (target), causing the material to evaporate and subsequently deposit on the substrate. EB evaporation is a high powered, flexible process with the ability to evaporate nearly any kind of material. The system can be used for aluminum metallization, AlO_x -coatings, and SiO_x -coatings, as well as other metal or metal oxide-coatings, and only requires minor modification to evaporate additional metals. As described previously for thermal deposition, EB evaporation can be either a reactive or non-reactive process.

Electron beam evaporation is a more powerful method of delivering the energy necessary to vaporize the source material. Its power and versatility makes the electron beam process extremely attractive to producers. Figure 3 diagrams a typical EB evaporation vacuum deposition chamber.



H. Volume for personal care segmented by end-use

Table 20 provides global consumption of transparent oxide-coated films in personal care applications, segmented by end-use.

END-USE	2009	2014	CAGR	2019	CAGR
Cosmetics	362.2	547.8	8.6%	809.0	8.1%
Personal hygiene	86.9	124.8	7.5%	162.2	5.4%
Other	106.0	172.3	10.2%	300.7	11.8%
Total	555.0	844.9	8.8%	1,271.9	8.5%

Source: Allied Development Corp.

The personal care market segment includes cosmetics, toothpaste, and others. We examine each end-use in the following paragraphs.

1. Cosmetics

Cosmetic products are often sensitive to moisture and can also be sensitive to oxygen. In addition, consumers rightfully insist on seeing the color or texture of cosmetics before purchasing. Oxide-coated films provide these properties and have garnered a small market share for cosmetics products. We project continued growth of 8.1% per year for cosmetics packaging through 2019 (Table 20).

2. Personal hygiene

The personal hygiene segment includes toothpaste and other personal hygiene products. The segment got its start in 2000, when toothpaste was commercialized in a transparent tube that included oxide-coated films for the barrier layer. Historically, aluminum foil was used for the barrier layer. The transparent tube was developed for the justice system. Prisoners had used non-transparent toothpaste tubes to