

## **CIGARETTE COMPONENTS**

A look at how filters and papers have evolved in the last half century.

By Brandy Brinson

In honor of CORESTA's 50th anniversary, *Tobacco Reporter* asked some industry veterans to look back on how cigarettes and smoking have changed through the years.

Brian Ace, who spent many years with Filtrona, and is now president of paper manufacturer Cartiera Maglio recalls the old days with a bit of nostalgia, "I do not go back 50 years, but not far from it. In those dark old days, cigarettes were virtually all plain and strong as hell. Nicotine-stained fingers, regular pummy stone scrubbing. Great fun to smoke, though the paper sometimes stuck to your lips and bits of tobacco would fill your mouth. Meeting rooms were like gas chambers with full ashtrays and your eyes would water continuously. In cinemas, the film would be seen only through rising clouds of smoke. London's underground tube trains were 90 percent smoking—not only unpleasant, but lethal. Some cigarettes resembled cigars in their taste and strength. Smoking was fashionable, a social habit to be shared with friends. An essential after sex. Smoking was fun."

Cigarettes have come a long way since those days. Thanks to filters, gone are the days of tobacco bits falling out into the mouth as well as yellow-stained fingers. But the roles of filters as well as papers have evolved into much more technical functions as new regulations are required and reduced-risk products are pursued.

**EVOLUTION OF FILTERS.** Ace explains the origins of cigarette filters. "The first filters came along following ancient textile processes combining various materials—crepe filters. These were quickly followed by paper filters, a simpler two process affair eventually perfected into a single process. Cellulose acetate began life with massive filament deniers and total deniers. The acetate filter eventually spread globally because of its appearance. Other fibers including polypropylene were tried—though filament bonding was not possible. Multiple filters appeared which combined the virtues of various materials and permitted the use of additives such as activated carbon."

Filters were initially used to simply keep loose tobacco out of smoker's mouths, but they evolved into much more. Mike Taylor of Filtrona, says, "As the role of the filter developed, it became a tool for adjusting the tar and nicotine yields of the cigarette by using higher or lower retention efficiency. As cigarette tar yields fell, higher retention efficiencies were required and more complex filters with higher retention capabilities were used. Filters with granular additives especially carbon, initially used in Japan, became more common."

Filters also took on other roles. Taylor says, "Filters have also been used as flavor carriers. If we look at the progression of filter development chronologically, but not necessarily in exact order, from about 1950 we can see, as shown below that initially monofilters only were used. These monofilters were

either paper or acetate although acetate quickly became established as the major filter material. The first commercial brand to use a monoacetate filter was launched in 1952. One of the first innovations was the use of dual filters allowing two different materials to be used in series in the same filter. Of course once dual filters were developed, the use of carbon was possible, as carbon needed to be placed in a filter away from the mouth end of the product. Triple filters allowing carbon to be placed in a cavity between two filter segments quickly followed. Probably at this time ventilation started to emerge as a method of yield reduction and offered an alternative to filtration only as a method of reducing cigarette yields.”

Today, filters are used in a variety of capacities. Taylor says, “As markets became more sophisticated, shaped filters were used. These were initially for product differentiation but are often currently used for their anti-counterfeit properties. As cigarette yields continued to fall, higher retention filters at acceptable pressure drops were required and advanced mono filters with higher levels of retention at the same pressure drop as a standard acetate filter became available. One such example which is still going strong today is the Filtrona combined performance filter (CPF) introduced in the late seventies which gives up to 10 percent extra tar and nicotine retention when compared to a monoacetate filter at the same pressure drop. Filters also began to be used as flavor carriers for mainly mentholated products. Further developments have seen the introduction of recess filters, which have proved particularly successful in Eastern Europe. More complex filter constructions also became available with the introduction of dual filters with the two-filtration media in parallel rather than series. Recent developments have seen more focus on reduced exposure products and have seen the introduction of more selective filtration products such as Ion Exchange Resins in new cigarette launches. More recently (in 2005) the launch of monofilters containing carbon has allowed the use of carbon in filters with a simpler construction.”

An integral part of the filter, filter tow has evolved along with the filter as a whole. Paul Rustemeyer, director of R&D for Rhodia Acetow, says that in the last 50 years, the major development has been that “the total denier went down as well as denier per filament. In parallel, Rhodia Filter Tow’s crimp became more fine.”

**PAPERS.** Papers, too, have evolved from simple beginnings to become complex components of cigarettes. The materials used to make cigarette paper have changed through the years.

“Fifty years ago, cigarette paper had a simple function to wrap the tobacco rod, to keep the tobacco in place and to keep the cigarette burning. For technical reasons, cigarette paper was mainly produced from flax fibers or similar very strong years plant fiber material. As the tools for paper making became more sophisticated, wood-based pulp was a second more economical option as a fiber raw material,” says Martina Radlingmayr in corporate marketing for Trierenberg.

“In its early days, ground chalk was used as a filler material. Nowadays precipitated calcium carbonate (PCC) is commonly used as filler for cigarette paper to accommodate purity and opacity requirements. Needless to say that the PCC also effects burn characteristics and the paper porosity. Many salts of inorganic and organic acids including nitrates have been used to promote the burn characteristics of a cigarette paper. Nowadays, a very well balanced ratio of sodium and potassium citrates is used predominantly to control smoke yields and provide taste.”

Plug wrap, too, has changed significantly through the years. “Plug wrap paper used to be a not very sophisticated product having the plain function of holding the acetate tow or the paper filter material at a very low manufacturing speed together. With the introduction of filter ventilation, highly porous plug wrap emerged on the market. The manufacturing technology for these special papers was newly developed. Uniformity and glueability became a demanding quality issue, requiring new binder recipes and new fiber formulations.”

Radlingmayr says the basic rules for paper technology have not changed significantly over the years, but the machinery has. “Any modern paper machine nowadays is fully process-controlled. The entire material flow from pulping to beating and to the paper machine is fully integrated and computer controlled. As paper bobbin uniformity is a major quality prerequisite for the use on high speed and robotized machine equipment, the slitting process today is completely upgraded with many controlling and adjusting features. This includes optical inspection systems and traceability coding.”

**MEETING REGULATIONS.** Today, suppliers of cigarette components are focused on helping manufacturers meet ever-growing regulatory requirements as well as develop PREPs (potentially reduced exposure products).

The pace of regulations is picking up, keeping suppliers and manufacturers on their toes. “Some of the regulations are the same as before such as regulatory maximum tar, nicotine and carbon monoxide yields. But more regulations are coming in to force re the banning of smoking in public places and declaration of ingredients used for all aspects of cigarette production. The banning of smoking in buildings and the potential for smokers to collect in one area outside a particular building may give rise to an increase in litter awareness and hence a drive for more degradable/biodegradable products,” says Taylor.

For paper suppliers, lower ignition propensity (LIP) products continue to be a focus as more governments around the world consider requiring “fire-safe” cigarettes. Ace comments, “The idea of ‘fire-safe’ cigarettes was born in the U.S.—a classical misnomer. The development of LIP is still unpredictable but has huge significance for cigarette paper producers.”

**PREPs.** Perhaps the most challenging area for suppliers is the development of PREPs.

Taylor explains, “As the requirement to assist in the development of PREP products increases, so does the challenge to component suppliers. It is a requirement for PREP products to reduce all harmful compounds in smoke

without adding any new compounds to smoke. As no clear definition of a PREP product exists, this can lead to marketing issues as it is difficult to position new products. It could be that significantly reduced yields of toxic compounds may lead to reduced risk, but until this is clearly demonstrated it is only a possibility. But often the development of new products requires the use of new materials. As things stand at the moment, it is more and more difficult to use new materials in products. Our major challenge is to significantly enhance the removal of undesirable components in smoke without introducing any other risks.”

He says it is expected that filters will be one of the main contributors to the development of PREP products. “This would be mainly via the use of carbon and possibly new novel adsorbent materials, perhaps coupled with novel filter constructions to help reduce the ratio of carbon monoxide to tar in smoke. Selective filtration of non-volatile materials such as TSNA’s and aromatic amines is not possible with a filter so developments in that area will have to come from other cigarette components but for many semi-volatile and volatile organic compounds the filter will have a major role to play in significant reductions of these compounds.”

Rustemeyer adds, “Filter additives are able to remove selectively components out of the gas phase of the smoke. This can be an important contribution in the development of PREPs. Furthermore, flavor additives can be stored in filters.”

Radlingmayr says papers will also play an important role in PREPs. “Non-tobacco components are important design tools for the products today. Irrespective of which way PREP development will go in the future, the paper component will keep its eminent role. Specific and additional functionalities provided by more sophisticated technologies may assist future concepts, hence may be limited to facilitate tobacco-related strategies.”

**FUTURE DIRECTIONS.** Moving forward, Radlingmayr says the major issues facing suppliers of cigarette components include providing the market with products that allow for legal compliance; allow for the production of less harmful products; satisfy consumer taste preferences; and meet consumers’ aesthetic preferences.”

As for filters, Rustemeyer foresees “more sophisticated filters which reduce the amount of Hoffmann analytes or other harmful components in the smoke.”

Taylor adds, “As far as filters are concerned it is expected that the current trends will continue so that filters will get longer and smaller in diameter. The trend towards lower yield products seems to be firmly established perhaps leading to an increase in the number and type of flavored products. Carbon products will continue to increase in popularity. Other filtration medium such as ion exchange resins and selective carbons, for example, will become increasingly common in the future. Perhaps catalysts and other selective adsorbents will also have a role to play. Probably new products will combine these new materials with the traditional properties of carbon.”

Looking into the future, Radlingmayr says, "It might be advantageous to differentiate between a mid-term (five to 10 years) and a long-term (10 yrs +) perspective. In the years to come, we will still deal with the cigarette which we know today. We would still be burning/pyrolyzing tobacco. The product would be a very carefully designed technical product based on naturally occurring raw materials. The main physical and chemical parameters will be strictly controlled and kept within very tight limits.

"In more distant future we also might anticipate products, which might encompass different nicotine transfer concepts for the consumer. Innovative concepts for non-tobacco components might be indispensable tools for altering or adding specific functions for the product. Some concrete innovations might include side-stream smoke modification, ignition propensity reduction, reduction of specific smoke constituents and optical performance."

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### **Responding to the call**

As the needs in the marketplace have evolved, suppliers of cigarette components have responded with a variety of innovative products.

**FILTRONA.** Taylor explains how Filtrona has met those needs. "The marketplace has required new developments for a range of applications—to reduce tar and nicotine, for brand differentiation, to reduce the yields of other compounds in smoke and the development of PREP products. Over the years, Filtrona has produced a range of products to meet these needs. For example, the CPF filter, a monofilter with higher tar and nicotine retention efficiencies than monacetate, has recently been improved to increase the visual differentiation, the CPA, filter so this product now offers the benefits of greater brand differentiation (and anti-counterfeiting) with higher retention efficiency.

"Carbon has long been recognized as a filter additive that increases the efficiency of filters towards many harmful products not filtered by standard filters. Normally the use of carbon requires a dual (or triple) filter construction and can give a unique carbon taste to the smoke. A new monocarbon (active patch filter APF) filter allows the benefits of carbon filtration without the usual carbon taste."

Today, he says a major growth area is slim-line cigarette products. Filtrona has developed many of the specialist filters in its range to be available for slim-line products such as CPF and APF.

Moving forward, Taylor says, "Filtrona's future direction will be to contribute in a number of areas for filter supply. The global manufacturing footprint will continue to be refined to give our customers the best possible service at optimum cost levels. Machinery and process developments will continue to allow higher speed production of filters with the most exacting of quality control limits. New product development will concentrate on products for yield reductions both overall and via new selective filtration media. Brand differentiation and anti-counterfeit products will also play a large part in future product development."

**TRIERENBERG.** Trierenberg has innovated products based on geographical differences. Radlingmayr says, “Consumer preferences and market needs vary all over the world. The Asian market is more focused on visual features of a cigarette whereas the Western Europe market is more aiming at a very well balanced ratio of smoke yields and taste. Needless to say that legal compliance is mandatory. Wattens Papier and its affiliates like OP papirna have launched special design cigarette papers for the Asian market. These papers in a large variety carry different images. For the Western European market, we have developed a large number of cigarette papers containing technical features to control smoke yields and to contribute to the taste.”

**RHODIA.** As filter tow requirements have evolved, Rhodia has worked to keep up with the needs in the marketplace. Rustemeyer says regularity of filter rods has been an important issue.

“Rhodia Filter Tow improved constantly on regularity which is a pre-requirement for higher processing speeds on the rod makers. But variability depends also on the rod-making process. Rhodia designed for its customers an improved Rhodia-Tongue for the rod maker, which gives more constant filter rods and allows to save at the same time up to 1 percent of filter tow yield.”

He says Rhodia worked proactively for many years in the field of best practices for filter rod-making and filter rod measurement methods—hot collapse tester, improved hardness by higher triacetin brush speed, microwave measurement of triacetin content, selected rods as a means of achieving more precise measurements, etc.

In the 1970s, Rhodia developed a special super crimped tow (Rhodia SK Tow) which allowed the customer to achieve a higher pressure drop range at a better yield. Thus, Rhodia SK-Tow is often applied in special filters.

“Rhodia worked for many years on the mechanisms of aerosol filtration, on additives for selective retention and on the behavior of additives on filter tow in cigarette filters. This also includes practical research on the comportment of granules like active carbon imbedded in acetate tow filters,” says Rustemeyer.

**CARTIERA MAGLIO.** Ace sums up the pace of innovation, saying, “As you can see, the industry has changed radically in all senses in the past 50 years. It remains highly profitable and invests hugely not only in technology but also in research. It is capable of change and does it with great success. Its approach to CORESTA is extremely open and this guarantees also for CORESTA a long, long future. Certainly Maglio will continue its dedication to the cigarette industry and provide a supply option that is quality conscious, flexible and competitive.”