



ACS
Chemistry for Life®

National Historic Chemical Landmarks

Chemists and Chemistry that Transformed Our Lives



FOR 120 YEARS
FOR 6 MONTHS
2 COATS
DAY-GLO



COLOR	CODE	STANDARD PACKAGING	SIZE
Aurora Pink	205-11	ONE COAT SUNBONDED DAY-GLO	1/2 Pint
Neon Red	205-12		1/2 Pint
Rocket Red	205-13		1/2 Pint
Fire Orange	205-14		1/2 Pint
Blaze Orange	205-15		1/2 Pint
Saturn Yellow	205-16		1/2 Pint
Arc Yellow	205-17		1/2 Pint
Signal Green	205-18		1/2 Pint
Filteray Yellow	205-19		1/2 Pint
Brushing Yellow	205-20		1/2 Pint

Brightest Colors in the World

DayGlo® Fluorescent Pigments

Brighter, Longer Lasting Color

SEPTEMBER 8, 2012

American Chemical Society

“Fluorescent color is seen 75 percent sooner than conventional color! Fluorescent color is three times brighter than regular color! Your eyes go back to fluorescent color for a second look 59 percent of the time!”

— DayGlo promotional material, undated

“The object of my invention is to provide a fluorescent lithographing ink...which, after being used in a lithographing process and when subjected to ultra violet rays, will become brilliantly fluorescent in many colors...”
Joe Switzer, 1936 patent application

THE SWITZER BROTHERS

Brothers Robert (Bob) and Joseph (Joe) Switzer were teenagers in Berkeley, California, in the 1930s. The Great Depression was raging, and life was difficult for the Switzer family. Their father, Emmet, and mother, Maude, operated a pharmacy with the help of their four children.

During the summer of 1933, Bob, a pre-med student at the University of California at Berkeley, found a summer job in an H. J. Heinz Company quality control laboratory to help support the family. One of his duties was to take samples from incoming shipments. A serious accident occurred while unloading a freight car, and Bob was found unconscious lying beside the train tracks. His skull fractured in the accident, Bob awoke in the hospital with brain damage, a partially severed optic nerve, double vision, and extensive loss of memory.

Bob spent the next few months recuperating at home. For his eyesight to recover, doctors recommended that he avoid bright light. During this time, Bob and Joe developed a curiosity about fluorescence, which they investigated using a portable black light amongst the materials stored in their family’s pharmacy.

Black lights emit ultraviolet (UV) light, an invisible class of electromagnetic radiation with a higher frequency than visible light but lower than X-rays. Fluorescent materials absorb the UV light and reemit it as visible light. In darkness, UV fluorescent objects appear to glow when exposed to black light.

The brothers found several naturally-fluorescing organic compounds and realized that they could be used to enhance Joe’s amateur magic shows. They went about experimenting with ways to turn the fluorescing compounds into

paint and had some early success combining the materials with shellac. Joe used their experimental paint to design costumes that glowed onstage under black light. In 1934, Joe performed his “Magic Balinese Illusion,” which uses fluorescent costumes to make a dancer appear and contort, earning a prize for best illusion during a magicians’ convention in Oakland.

Following the success of their early onstage illusions, the brothers soon realized the potential for development of fluorescents in advertising and merchandise display. The first written record that predicts the development of fluorescent technology, written by Bob in 1934, describes Joe as having “conceived the idea of projecting ultra violet light ... upon all displayable articles which fluoresce (or are treated with fluorescent materials) to produce a beautiful and noble method of displaying merchandise.”

ULTRAVIOLET FLUORESCENTS

In 1934 the Switzers established their first company, the Fluor-S-Art Co., and partnered with San Francisco artist Delmar Gray to produce fluorescent displays for commercial advertising. They also contributed advances in black lighting for such displays.

An early display designed for a San Francisco department store failed, however, when street lighting interfered with the black light effects. Because fluorescent paint relied on ultraviolet light, it could only be successful where conditions allowed for complete control of lighting conditions. Light pollution, deficiencies in black light sources, and exposure to sunlight all contributed to the degradation of fluorescent displays.

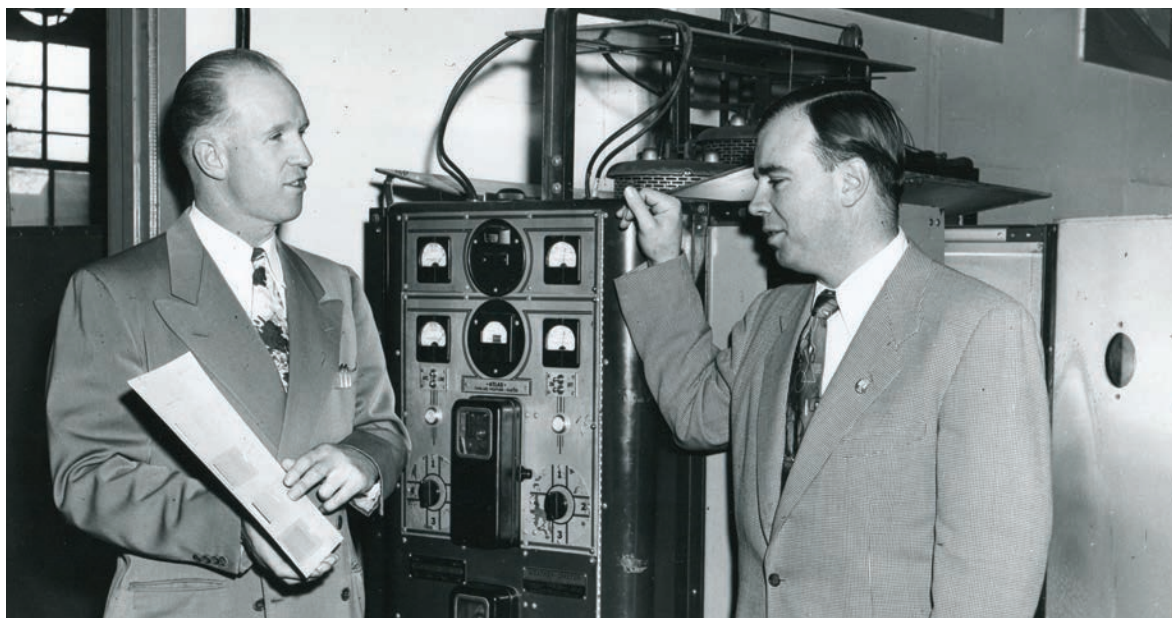
Later the same year, an indoor department store display became a popular success, using fluorescent

paint and flowing liquids to create a Christmas scene. The following year, Joe met with representatives from Continental Lithograph, an advertising subsidiary of Warner Bros. Pictures located in Cleveland, Ohio. The company specialized in producing posters for the motion picture industry. Joe sold Continental on the idea of producing fluorescent posters illuminated in theater lobbies by black light. To demonstrate the fluorescent effects, the Switzer brothers, along with artist Gray, designed a display that filled the monumental lobby of Cleveland’s Hippodrome movie house. The display was a success, and Continental was sold on the power of fluorescent displays for Warner Bros. theaters across the country.

While early posters were painted by hand, the volume of prints purchased by Continental required the development of fluorescent lithography and silk-screen inks. It was at this time that Joe became involved in the development of printing inks. With the help of Dick Forbes of Forbes Ink Co., Joe made hundreds of test batches and ultimately developed a new manufacturing method for fluorescent ink. At the time, fluorescent paint was prepared using white shellac colored with fluorescent dyes and dissolved in alcohol—a product not suitable for mixing with oily printing ink varnishes. Joe developed a process that used water to absorb the alcohol, which then could be easily separated from the oil contents. This process could be used to produce fluorescent inks that worked well on presses.

DAYLIGHT FLUORESCENTS AND WWII

Despite these early successes, the brothers saw that they would



Bob and Joe Switzer inside the Switzer Bros., Inc. factory in Cleveland, Ohio, in 1952.

need to develop new products that overcame their limitations. Beginning in the early 1940s, the Switzers began making improvements in a class of pigments they called “daylight fluorescents,” which not only fluoresce under black light conditions, but also in daylight. Simply described, daylight fluorescents convert energy from the ultraviolet spectrum and transform them into longer wavelengths that are visible to the human eye. An object coated with a specific daylight fluorescent pigment reflects its visible color and absorbs and transforms UV wavelengths into this color. This creates the visual effect of super brilliance, and is comparatively brighter than standard color. These products became known as DayGlo fluorescents.

Fluorescent products of both kinds found use by the military during World War II for a variety of visual signaling purposes. UV fluorescing materials allowed Allies to use aircraft carriers at night, an advantage over the Japanese military. DayGlo fluorescent fabric panels were used by troops in North Africa to identify themselves as friendly to Allied aircraft. After the War, U.S. aircraft were painted with the signature DayGlo “Blaze Orange” color to increase their visibility and avoid mid-air collisions.

The Switzers also introduced black light fluorescent penetrants that

were found to be useful for the war effort and are still used today. The penetrants are applied to the metal parts, settle into unseen cracks and other flaws, and show these defects under black light. Two systems—Magnaglo® and Zyglo®—utilized fluorescence in flaw detection. Zyglo, a process that did not rely on magnetic principles and was therefore effective on aluminum (a key component of airplane parts), was particularly important and soon was required by the U.S. Air Force for use on a variety of critical parts to ensure part quality.

COMMERCIAL PRODUCTS

In 1946, the Switzer Brothers ended their agreements with Continental and founded Switzer Brothers, Inc. (now Day-Glo Color Corp.), in Cleveland. Flaw detection products continued to be a large portion of their product lines, but they also expanded their research to improve daylight fluorescent pigments for commercial uses.

After a series of developments in the field, a milestone came in 1957 with the patent for a new process for producing daylight fluorescent pigments. Combining the fluorescent dyes with a new class of polymers and then milling the composition to an appropriate particle size produced material that behaved like traditional organic and inorganic pigments in printing techniques. These new pigments could be used as traditional paint

and inks and had sufficient light stability to be used outdoors.

Growth in the use of fluorescent pigments for marketing and packaging took off following the War. The company made inroads by marketing their products—DayGlo-brand silk-screen inks, paint, and papers—to advertisers. Their first big break in packaging came in 1959 in an application that’s still known by its DayGlo colors today: Tide® detergent. Fluorescent boxes of Tide were soon on display on grocery shelves nationwide, and fluorescent colors began to appear on an increasing number of consumer products.

Safety applications became another major market for fluorescent colors: Traffic cones, safety vests, and many other products for which enhanced visibility is of great importance are all colored by fluorescent pigments. Today, firefighters, construction workers, crossing guards, and many others are identified by the fluorescent colors emblazoned on their uniforms.

By the 1960s, fluorescent colors had become ubiquitous with the emergence of psychedelic posters, clothing, toys, and accessories of the 1960s. From hippies to Pop artists, a new fluorescent identity had emerged in DayGlo’s fluorescent palette: Corona Magenta, Aurora Pink, Rocket Red, Fire Orange, Blaze Orange, Arc Yellow, Saturn Yellow, and Signal Green.

“The fluorescent color was a highly exciting and new advertising medium. People were startled by it.”
Gordon Russell,
former Day-Glo Color Corp.
Vice President of Marketing

DayGlo Fluorescent Pigments National Historic Chemical Landmark

The American Chemical Society designated the development of DayGlo Fluorescent Pigments as a National Historic Chemical Landmark in a ceremony in Cleveland, Ohio, on September 8, 2012. The commemorative plaque at Day-Glo Color Corp. reads

DayGlo fluorescent pigments, a new class of pigments based on fluorescent dyes and polymeric materials, were developed between the 1930s and 1950s by scientists at Switzer Brothers, Inc. (now Day-Glo Color Corp.). These pigments absorb various light frequencies (visible and invisible to the human eye) and reemit them, producing intense visible colors that appear to glow, even in daylight. Switzer Brothers, Inc., introduced novel processes that eliminated the limitations in lightfastness and color strength of earlier fluorescent pigments, resulting in new applications in advertising, packaging, flaw detection and safety. These products were used to support Allied troops during World War II, were immortalized in psychedelic posters of the 1960s, and are familiar today in the bright colors of toys, construction cones and safety vests.

About the National Historic Chemical Landmarks Program

The American Chemical Society created the National Historic Chemical Landmarks program in 1992 to enhance public appreciation for the contributions of the chemical sciences to modern life in the United States and to encourage a sense of pride in their practitioners. The program does this by recognizing seminal achievements in the chemical sciences, recording their histories, and providing information and resources about Landmark achievements. Prospective Landmarks are nominated by ACS local sections, divisions, or committees; reviewed by the ACS National Historic Chemical Landmarks committee; and approved by the ACS Board Committee on Public Affairs and Public Relations.

The American Chemical Society is a nonprofit organization chartered by the U.S. Congress. With more than 164,000 members, ACS is the world's largest scientific society and a global leader in providing access to chemistry-related research through its multiple databases, peer-reviewed journals, and scientific conferences. Its main offices are in Washington, D.C., and Columbus, Ohio.

Acknowledgments:

Written by Keith Lindblom.

The author wishes to thank contributors and reviewers of this booklet, all of whom helped to improve its content. Special thanks to Fred Switzer (youngest of the Switzer brothers), Paul Switzer (son of Bob Switzer), and Milton Allen. Liesa Bing's 1991 record, *The Story of Switzer Magic DayGlo*®, provided important information for the booklet. Thanks to the National Historic Chemical Landmarks Subcommittee and DayGlo Organizing Committee for review and encouragement. Any remaining errors are the author's alone.

Image Credits: Day-Glo Color Corp. and Paul Switzer.

DayGlo, Corona Magenta, Aurora Pink, Rocket Red, Fire Orange, Blaze Orange, Arc Yellow, Saturn Yellow, and Signal Green are registered trademarks of Day-Glo Color Corp., an RPM International Inc. company.

Magnaglo and Zyglo are registered trademarks of Magnaflux, a division of Illinois Tool Works, Inc.

Tide is a registered trademark of The Procter & Gamble Company.

Designed by Barb Swartz, Design One. Printed by DUKE Printing.

© 2012 American Chemical Society

American Chemical Society

Bassam Z. Shakhshiri, President
Marinda Li Wu, President-elect
Nancy B. Jackson,
Immediate Past President
William F. Carroll, Chair, Board of Directors

Organizing Committee

Jon Aber, Day-Glo Color Corp.
Tom DiPietro, Day-Glo Color Corp.
Leanne Kocian, Day-Glo Color Corp.
Helen Mayer, ACS Cleveland Local Section
Dan Tyson, Day-Glo Color Corp.

Cleveland Local Section American Chemical Society

Kathleen Wollyung, Chair
Donald Jaworske, Chair-elect
Anna Bowman, Secretary
John Moran, Treasurer

American Chemical Society Subcommittee on National Historic Chemical Landmarks

Jeffrey L. Sturchio, Chair, Rabin Martin
Mary Ellen Bowden, Chemical
Heritage Foundation, Retired
Maureen Chan, Alcatel Lucent Bell
Laboratories, Retired
Carmen Giunta, Le Moyne College
Arthur Greenberg, University
of New Hampshire
Janan Hayes, Merced College, Retired
Diane Krone, Northern Highlands
Regional High School, Retired
Cheryl Martin, U.S. Department of Energy
Seymour Mauskopf, Duke University, Emeritus
Andreas Mayr, Stony Brook University
Daniel Menelly, Liberty Science Center
Michal Meyer, Chemical Heritage Foundation
William Oliver, Northern Kentucky
University, Emeritus
Heinz D. Roth, Rutgers University
Leo Slater, Naval Research Laboratory
Kathryn Steen, Drexel University
Edel Wasserman, DuPont, Retired
Kirsten White, Forest Park High School
Frankie Wood-Black, Trihydro Corporation



ACS
Chemistry for Life®

American Chemical Society

National Historic Chemical Landmarks Program
Office of Public Affairs
1155 Sixteenth Street, NW
Washington, D.C. 20036
landmarks@acs.org
www.acs.org/landmarks