



New materials, new methods = new expression in today's sculpture  
by Harriett Turner Wyman

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of  
MASTER OF APPLIED ART  
Montana State University  
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Abstract:

The work presented in this paper is in partial fulfillment of the requirements for the degree of Master of Applied Art at Montana State University in Bozeman, Montana, Current trends in sculpture indicate that more and more artists are using chemically produced synthetics as legitimate media for their work, I feel that this trend will not only continue, but will eventually dominate the sculpture material field of the future, I expect to continue in the academic field, as well as practicing sculpture myself, and therefore felt that a study of these new materials would be both worthwhile and necessary, I have had to use data prepared primarily for industrial use as the criteria for my selection of materials to be used for further consideration. Many other materials could have been included as possibly having future usage in the field of sculpture, but I have had to limit this study to those materials that I felt should be investigated for use at the present time for the sculptor, as well as the student-sculptor.

This paper is not intended to be a scientific discussion of the materials presented, but instead I have tried to present a cross-section of the materials already being marketed with the sculptor in mind.

I selected four different synthetically compounded materials which were subsequently used in experimental projects. Each of these materials could have presented enough comprehensive work for individual thesis projects. I felt, however, that work done on different types of material would give the sculptor some idea as to whether he might like to use this particular media for his own experimental investigation.

I found that these materials presented a challenge. I tried to select a meaningful experiment for each material chosen to be tested. Without exception, I would have liked to further investigate each media.

I feel that I shall, in the future use each of these new materials again, and wholeheartedly recommend an excursion into the field of plastic sculpture to today's sculptor.

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IN TODAY'S SCULPTURE

by

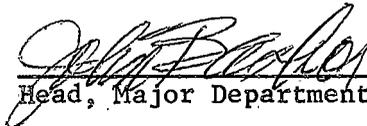
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A thesis submitted to the Graduate Faculty in partial  
fulfillment of the requirements for the degree

of

✓ MASTER OF APPLIED ART

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Bozeman, Montana

August, 1967

ACKNOWLEDGEMENT

I wish to take this opportunity to thank those who so graciously gave of their time and effort to help me in the completion of this work.

Mr. Cyril Conrad, Mr. John Geiser, Mr. Lawrence Hayes, and my daughter and son-in-law, Mr. and Mrs. Neal Schantz, for their influential interest which encouraged me to begin the study.

The members of my Graduate Committee: Mr. Charles Hanton, Chairman, Mr. John Bashor, Mr. Robert De Weese, Dr. Harry Hauser, and Mr. John Langenbach. The gentlemen who served pro-tem: Mr. John Geiser, Mr. Jerry Berneche, Mr. Tarmo Watia, Mr. Cyril Conrad, and Mr. Walter Jule.

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ABSTRACT

The work presented in this paper is in partial fulfillment of the requirements for the degree of Master of Applied Art at Montana State University in Bozeman, Montana.

Current trends in sculpture indicate that more and more artists are using chemically produced synthetics as legitimate media for their work. I feel that this trend will not only continue, but will eventually dominate the sculpture material field of the future.

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## INTRODUCTION

Art galleries and museums are accepting more and more sculpture done in the new materials. Plastics are not really new, but have been newly accepted as legitimate media for sculpture.

The sculptor, while cognizant of the new connotation of the word 'plastic' still initially interprets the word as meaning any substance which is sculptural, or capable of being used, by him, to express his idiom. Thus, to the sculptor, as to no one else, the plasticity of the newly developed, synthetically compounded materials are excitingly important.

Throughout history, industry has taken over the production of products made out of materials which were first introduced by the sculptors of that epoch. Industry reversed this procedure in the field of synthetic materials, however, and first used these man-made materials, before the sculptor discovered their potential.

When the industrialist, during World War II, found that many materials necessary to the war effort were becoming scarce, and often non-obtainable, he began a concerted investigation of synthetically produced, substitute materials. While some of these materials remained 'substitutes', many came to be accepted as new, legitimate materials, possessing workable properties heretofore unimagined. The field of synthetically compounded materials has just been opened up, for the chemist discovers new materials daily, while constantly revamping and improving the materials already being used.

A comprehensive study of all of the materials available today would

be impossible for the layman, however, the artist-supplier has had to do this very job, in order to keep abreast of the materials that might be used by the artist, as well as the craftsman. This preliminary study, by them, has been especially helpful in my study, as I began where they had left off in many instances. When I decided a certain type material seemed to have the properties desirable in the field of sculpture, I found that this material was being marketed by some manufacturer. By correspondence, I was able to obtain this material for my work. Local art dealers were anxious to order any materials that I wanted, for they, too, wanted to know the potential usage of each of these materials.

The sculptor has not been unaware of this silent revolution in the field of sculpture materials. Many are already using these synthetic materials in exciting ways, but many still feel the passee connotation of the word 'plastics' to be a stigma to his artistic creation.

T. R. Newman has done a great deal of research in the field of plastics, and I have found much helpful material on the potential of plastics in a recent publication by this artist-author.

## INTRODUCTION TO PLASTICS

Plastics are defined as substances which can be permanently formed or deformed under external stress or pressure, usually accelerated by the application of heat. The newly created form retains its shape by cooling, chemical action, or the removal of a solvent through evaporation.

Early in the century the artist Moholy-Nagy saw the future of plastics as an art medium, and warned the future artist that he must either take up scientific studies, or wait decades until knowledge about plastics became commonplace. This knowledge is more obtainable today, but is not yet commonplace. That the artist would seek this knowledge, in order to make use of this very versatile group of materials, has proven true, for they are becoming accepted art media. A scientific vocabulary, together with scientific knowledge would be helpful, but a perusal of available materials gives one enough vital information to be able to select a product that seems to have the characteristics that one is looking for to answer a specific need.

The basic component of any plastic is petroleum, gas, coal, sand, water and air. The differences inherent in the various plastic families are based upon the varying formulation of these components. Plastics fall into two general categories; the thermosetting plastics and the thermoplastics. The thermosetting plastics become solid when heated, while the thermoplastics soften when heated and harden while cooling. T. R. Newman, on page twenty-five of her book, Plastics, differentiates these two categories in this manner:

"Cross-linking of the thermosetting plastics holds chains.

of molecules tightly together. As a result, once the polymerization\* is completed and the polymer is hardened, heat will not soften it. The thermosets will not become fluid again if heat is applied but will remain solid up to their decomposition temperature. Clay is an example of a thermosetting material.

The thermoplastics, on the other hand, are made of coiled and long molecules intertwined in a tangled maze. When temperatures are normal, the molecules lie quietly. But once they are heated, the molecules begin to move around and the plastic becomes flexible again. Further melting causes the molecules to slip and slide over one another. The melted plastic becomes fluid. When cooled, the plastic will harden again and will go back to its original shape (this is often called plastic's "memory"). If heating continues, however, the thermoplastic will decompose. Metal is an example of a thermoplastic material. ....The plastic chemist actually takes natural resources apart, breaking them down to their basic molecules and atoms. With these building blocks he uses heat, pressure, or chemical action to cause these building blocks to combine in order to create the new polymer."

From the thermosetting resins I decided to work with epoxy, polyester resins, and urethane resin foam. Urethane resin falls into the thermoplastic category, but in its foam state become thermosetting. Aside from the acrylics, I felt that most of the thermoplastics held little

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\*Polymerization is the act of combining two or more molecules into a single larger molecule.

interest to the sculptor, at this time, due to the high heat and pressure needed in fabrication. Therefore the experimental work done for this thesis project was with these four compounds: epoxy, polyester resins, urethane resin foam, and acrylics.

Epoxy is a thermosetting resin product with almost limitless promise in the sculptural field. Its weatherability make it ideal for exterior work, while its light weight make it acceptable for large sculptures. It is quite expensive now, but has been used a great deal, in spite of this, because of its ability to accept additive fillers which not only extend the epoxy, but also create exciting finishes. Powders of different metals give metal-like sculptures. However, textures are possible with this material that are impossible in cast or welded metal sculptures.

The polyester resins can be divided into three general categories; casting resins, laminating resins, and putty glass. Although all of the polyester resins are virtually identical in composition, control of the catalytic element and the additives result in working properties that answer specific requirements.

Casting resins are used to form an object by pouring the catalyzed resin into a mold. Objects may be embedded in the castings if desired. These resins are compounded to be extremely clear. A meticulously refined product gives one-hundred percent clarity that does not distort in thick castings, but where less clarity is acceptable, a less expensive casting resin may be utilized.

The laminating resins are formulated to stay soft in the air, thus allowing complete bondage of subsequent coats of resin. The final coat

is made air-drying by the addition of a special catalyst to the resin.

Putty-glass has a thixotropic material added, which makes it thick enough to be applied to vertical surfaces.

Urethane resin foam is an exciting new sculptural material. It is formed, as are all the plastic foams, by the addition of gas or air into the cells of the plastic while it is being manufactured. A product, which is catalyzed and foams while the artist is forming his sculpture, is being marketed, while sheets and blocks of the already-foamed urethane resin are more usually obtainable. This foaming while sculpting process opens a new facet of the art to sculptors. I was unable to obtain the product, but feel sure that it will soon be available locally.

Acrylics, as Lucite and Plexiglass have been used for many years with splendid results. They are perfectly clear, and machine extremely well. However, a new type material has recently been marketed by Grumbacher, Inc. of New York. This utilizes a syrup consistency acrylic with marble dust, which dries to a hardness that can be machined or carved. It will also accept additives, and it was this property that I investigated.

NAME	AVAILABLE FORMS	MOLDING QUALITIES	MACHINING QUALITIES	SCULPTURE POTENTIAL
<u>THERMOSETTING RESINS</u>				
Epoxy	Molding compounds Liquid resins Foamed blocks Adhesives Coatings	Good	Unfilled epoxy is good Filled epoxy is poor	Almost limitless shows great promise Adheres to a great many surfaces
Polyester resins	Liquids Dry powders Pre-mixed molding compounds Cast sheets Rods & tubes	Very good	Good	Exceedingly versatile Almost limitless potential Needs little or no heat Can be catalyzed at room temperature Properties vary according to manner with which mixed 1. Styrene-based polyester 2. Acrylic-based polyester
Polyurethane (urethane)	Liquid & solids Foams: Slabs, sheets blocks 2 & 3 package system for on the job mixing a. open cell foam-in place (flexible) b. closed cell (rigid)	Good to excellent	Fair	Excellent for both subtractive and additive methods
<u>THERMOPLASTICS</u>				
Acrylics (methyl methacrylate)	Rigid sheets Rods & tubes Molding powders Syrup & liquid	Excellent	Fair, for cast acrylics Excellent	Excellent potential as machined forms One form used as a modeling paste <sup>1/</sup>

<sup>1/</sup> Newman, Thelma, R. Plastic as an Art Form

## CHAPTER I

### THERMOSETTING RESINS

#### Epoxy Resin

The first experimental project in the thermosetting resin group was with epoxy resin. This product is extremely light weight when polymerized, had excellent weatherability, and accepts additive fillers with good results. Epoxy resin and polyester resin have similar properties. They may be used similarly, with almost identical results. Epoxy is used when shrinkage must be kept minimal, or where better water resistance is required. Epoxy, however, is more expensive and tends to be less clear than the polyesters. Fillers are used to make the resin less costly, or to improve its physical properties such as hardness, stiffness, or impact strength. The Fiberlay Company markets an epoxy resin called Epotuf. I used this product in my work, using aluminum powder as the additive filler. This may be used over a regular armature in an additive process, or used as an overcoating to a less stable material, such as one constructed of plaster. This coating renders the finished statue impervious to dampness and weathering, thus prolonging its life span. The finish can be made to resemble any metal that has been used as an additive. Many interesting textures may be obtained, using various tools on the surface, either while applying the epoxy mixture, or immediately thereafter.

#### Epoxy resin experimental project

My epoxy experimental project was a reclining nude statue. An

















































