

SILLY PUTTY®

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Silly Putty® is a silicone polymer, originally made in 1941 in an unsuccessful attempt to manufacture a silicon based synthetic rubber. Although it had no industrial value, since it does not retain its shape, a salesman who frequented the laboratory would give out samples of this unusual material to his clients. Eventually, Silly Putty® was marketed as a toy. It is usually packaged in small egg-shaped containers and is most commonly pink in color. Silly Putty® has also been available in fluorescent colors of green, blue, yellow, and red, with sparkles (small metallic flakes), glow in the dark, and magnetic.



Silly Putty® is a non-Newtonian fluid that has dilatant properties. That is, it tends to dilate or expand under stress rather than be compressed as a rubber ball. For this reason, it has some unique properties:

- a) Under low stress, such as slowly pulling the Silly Putty® apart, the putty flows forming thin strands.
- b) Under high stress, such as a sharp pull, the putty breaks.
- c) If rolled into a ball and dropped, the putty will bounce.
- d) If the ball of putty is placed on a table top and hit with the hand, the ball will hardly be deformed. If hit with a hammer, the putty will shatter. Yet, if it is squeezed gently, the ball will flatten.
- e) If the putty is stuffed through a tube, it will swell as it emerges from the open end. This is known as die-swell. (This works well with freshly prepared putty as the putty tends to harden with age.)

EXPERIMENTING WITH SILLY PUTTY®

PROCEDURE

1. Materials needed

Silly Putty®
hammer
wood board (approximately 15 cm square)
newspaper
magazine

2. Safety Precautions

There are no hazards from normal handling of Silly Putty®.

3. Experimental Procedure

Roll the Silly Putty® into a ball. Drop it on a smooth hard floor (not on a carpet). What happens?

Pull the Silly Putty® slowly. What happens?

Pull the Silly Putty® hard. What happens?

Roll a small piece of Silly Putty® into a ball. Place it on a wood board.

a) Hit it with your hand. What happens? Does it flatten?

b) Flatten the Silly Putty® slightly, then hit it with a hammer. What happens? (**CAUTION:** The hammer may rebound with a fair amount of force.)

Flatten a piece of Silly Putty.®

a) Press it on a picture in the newspaper. Lift the Silly Putty® off the newspaper. What happens?

b) Repeat this procedure using a picture from a page in a magazine. What happens?

c) Rub your finger across the newspaper print. Repeat using the magazine. Describe what happens.

The Silly Putty® will pick up the pictures from most newspapers, but usually not from magazines. This is due to the type inks used. Newspaper ink is made from mineral oil and finely powdered carbon (called carbon black), it never dries completely. This is observed if you rub your finger over the print. The ink used in magazines is dry, it will not transfer. The colored inks used in the Sunday comic sections of the newspaper may be a type that dry, like magazine inks, or may be the type similar to black newspaper ink, so some will be picked up by the Silly Putty and some may not.

PREPARATION OF A SILLY PUTTY TYPE MATERIAL

The preparation of Silly Putty requires a chemistry laboratory with an efficient fume hood. The starting material is dimethyldichlorosilane, $(\text{CH}_3)_2\text{SiCl}_2$ (a highly reactive compound), the use of diethyl ether (a highly flammable compound), and a polymerization at 200°C . This procedure will prepare a Silly Putty type material from a common household glue. The glue-putty produced will not have all the same properties of Silly Putty, but it is fun to work with.

PROCEDURE

1. Materials needed

Elmer's Glue-All white glue (this is a polyvinylacetate based glue)
4% borax solution (sodium borate, $\text{Na}_2\text{B}_4\text{O}_7$) - 20 Mule Team Borax or similar. Prepare by adding 4 grams borax to 96 grams water. (If a balance is not available, use 1 level tablespoon borax for each one cup (250 mL) water.)
water
5 oz paper cup
popsicle stick (or a stirring rod)
food color (optional)
paper towels
plastic bag (Zip-Lock type or with a twist tie)

2. Safety Precautions

There are no hazards from the normal handling of this material.

Do not get any glue on your clothes.

3. Experimental Procedure

Measure 25 mL of Elmer's white glue into a paper cup. Add 20 mL of water and stir well. If desired, up to 5 drops of food color can be added. Stir well.

Add 5 mL of borax solution and stir well.

Remove the solid material. Pull the solid off the stirrer. This material will be sticky for about one or two minutes.

Test the material:

Does it stretch?

What happens when it is pulled hard?

Roll a piece into a ball and drop it on a hard surface. Does it bounce?

Store the Elmer's Glue putty in a plastic bag. Before storage, moistening the glue putty with a small amount of water will help to keep it soft.

4. Clean-up and Disposal

Any liquid left in the paper cup can be poured down the drain with the water running.

The paper cup and popsicle stick stirrer can be thrown in the trash.

NOTE: For additional variations on this recipe, see Katz, David A., Gak, and Ooze Ball, at Chemistry in the Toy Store, at. <http://www.chymist.com>

A silicone putty, similar to Silly Putty, in various colors, glow-in-the-dark, magnetic, and more is available from Crazy Aaron's Putty World. <http://www.puttyworld.com/>