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EUROPEAN TEXTILE NETWORK
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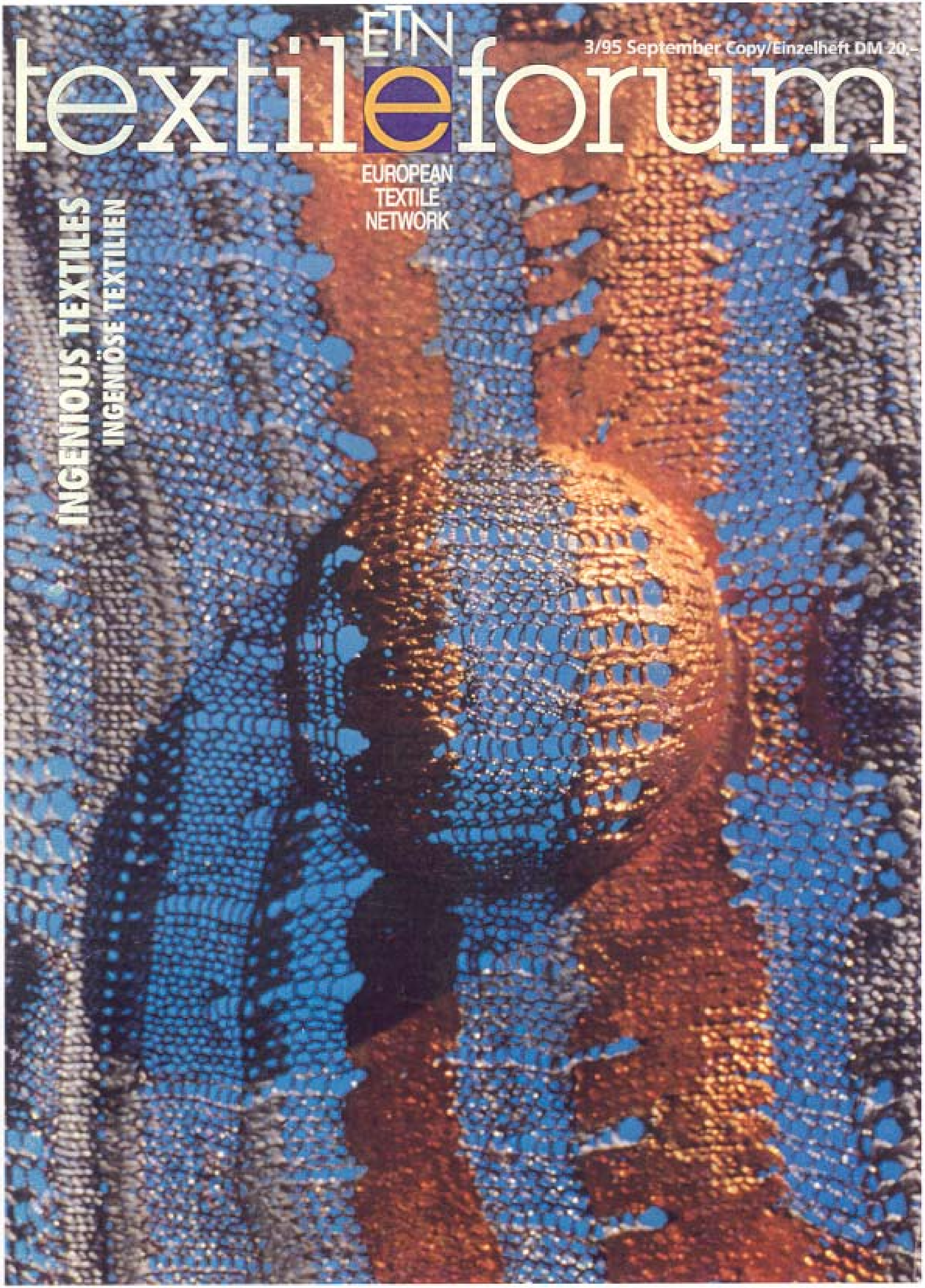
## INGENIOUS TEXTILES
## INGENIÖSE TEXTILIEN



# THIRD-GENERATION MEMBRANE STRUCTURES

Ade Adekola

It is becoming clear that buildings contribute significantly to the serious environmental problems of the planet. On the eve of the oil embargo, it was cheaper to burn lights continuously in glass buildings, day and night, than to install light switches. Pre-oil crisis modernity lacked environmental consciousness as a design parameter. Industrialisation and an abundance of energy led to a reliance on mechanical HVAC and lighting systems and the consequent degeneration of the building envelope as an environmental moderator. The building envelope had become oblivious of the climate, and indoor conditions were mechanically controlled by the user.

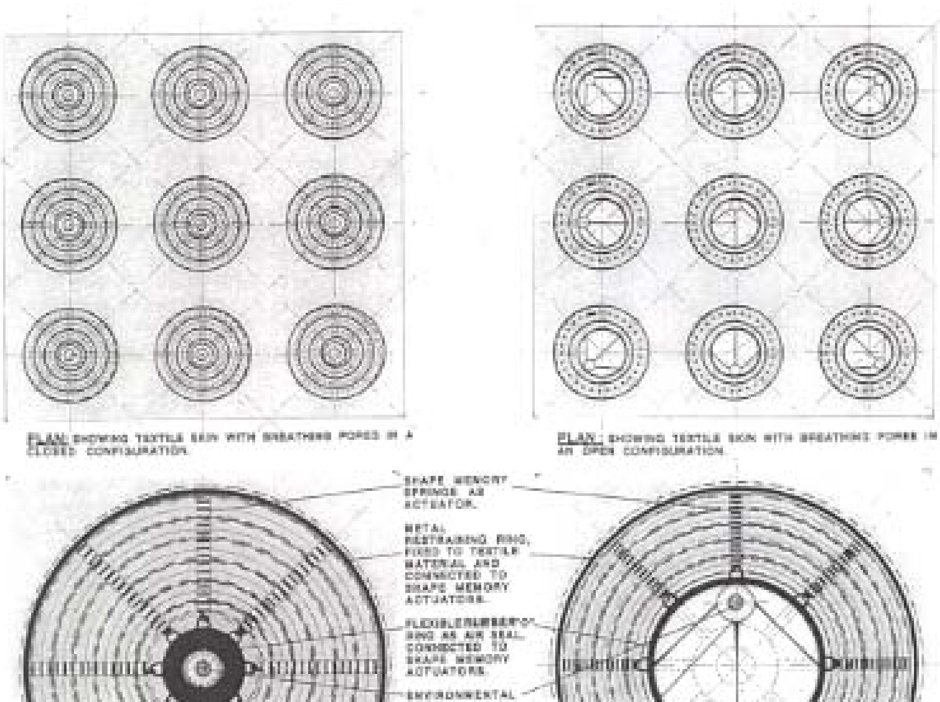
The resultant energy crisis, global warming and damage to the ozone layer has resulted in a paradigm shift over the past 25 years.

The objective now is redefining the parameters involved in the design of buildings and their constituent elements and components.

In general terms, the materials that are of interest in this field are those that can "alter state" in response to external stimuli (either directly or through some medium of control), or those that can in any way provide a new solution to a particular design criteria, or project the development of new design criteria.

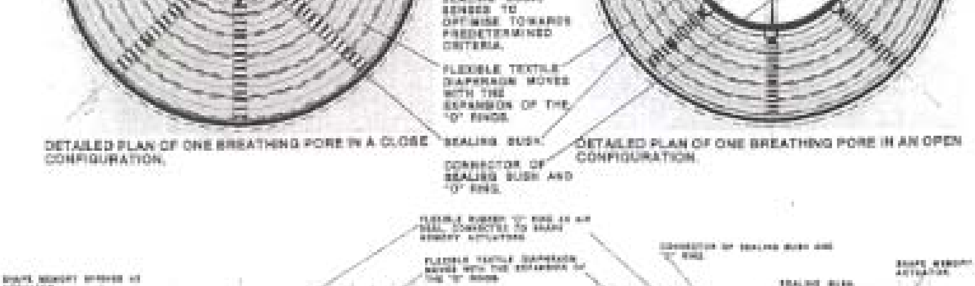
## BREATHING PORES IN A TEXTILE MEMBRANE, RESPONSIVE DESIGN WITH VENTILATING CAPABILITIES

This design can be made to optimise towards set criteria like air movement, heat, light, sound, human activity, solar radiation etc. All that is needed is to alter the sensor and sensing parameters.



PLAN: SHOWING TEXTILE SKIN WITH BREATHING PORES IN A CLOSED CONFIGURATION.

PLAN: SHOWING TEXTILE SKIN WITH BREATHING PORES IN AN OPEN CONFIGURATION.




DETAILED PLAN OF ONE BREATHING PORE IN A CLOSE CONFIGURATION.

DETAILED PLAN OF ONE BREATHING PORE IN AN OPEN CONFIGURATION.

DETAILED SECTION SHOWING MECHANISM OF ONE BREATHING PORE IN A CLOSE CONFIGURATION.

DETAILED SECTION SHOWING MECHANISM OF ONE BREATHING PORE IN AN OPEN CONFIGURATION.

## SURFACE KINETIC INTEGRAL MEMBRANE (S.K.I.M.)

S.K.I.M. is an explorative design of a composite material towards the realisation of a dynamic system where the actuative and the sensory layer are embodied within the structure of the material. The design exploits the use of electrorheological fluid [1] and current carrying coils inducing a magnetic field as the actuative material within a flexible latex membrane. The composite design has three effective layers; the first is a flexible latex layer with piezo-electric [2] sensors embedded within it this layer acts as a feed forward control interface. The second layer, the most complex, has three components: fluids, localised contact electrodes, and current carrying coils arranged in concentric circles to induce magnetic fields. The third layer is in effect a mirror of the first and acts as a feed back control interface. With this basic composite structure various profiles can be induced in the material. ■


**On the author**

Born in Nigeria in 1966, Ade Adekola graduated in archaelogy at Manchester University in 1989. He has presented his work on reactive and "smart" materials at events such as the 6th International Techtextil Symposium, Frankfurt, 1994, and the Second European Conference on Smart Structures and Materials, Glasgow, 1994 as well as in various printed media. Since 1993 he has been running his own business: Innovative Design Systems, 48 North Street, London, SW4 0HD, UK; tel: +44-171/7204403; fax: /7388241


The author is examining a number of further textile-based, building-related elements and phenomena, all of them intended to contribute to ecological building construction. For example, he presented a study on generating electricity from wind energy in a system using Kevlar sails. We shall only reproduce his study entitled "Breathing Pores in a Textile Membrane"; to us, this seems the most obvious documentation for lay eyes (editor's note).

**Notes**

[1] **Electro-rheological fluids (ER fluids)** are composites containing polarised particles that stiffen when exposed to an electric field; the process is fully reversible. The fluid is nonconductive and consists of oil and water with solids including starch and polymer particles. Their "smartness" stems from their ability to act as an interface between the electronic and mechanical control of many smart materials. The potential of ER fluids at present is mainly confined to civil engineering and automotive industry.

[2] **Piezo-electric materials** transform energy from mechanical to electrical and viceversa, giving the materials sensing and actuating capabilities. The range of materials which can display piezo-electric qualities includes crystals, ceramics, polymers and ceramic/polymer composites. Ceramics are often used as actuators while the polymers are applied for their sensing capabilities. Car industry companies are examining the possibility of using piezo-electric ceramics as shock absorbers while piezo-electric polymers are being used as artificial muscles for robots.