
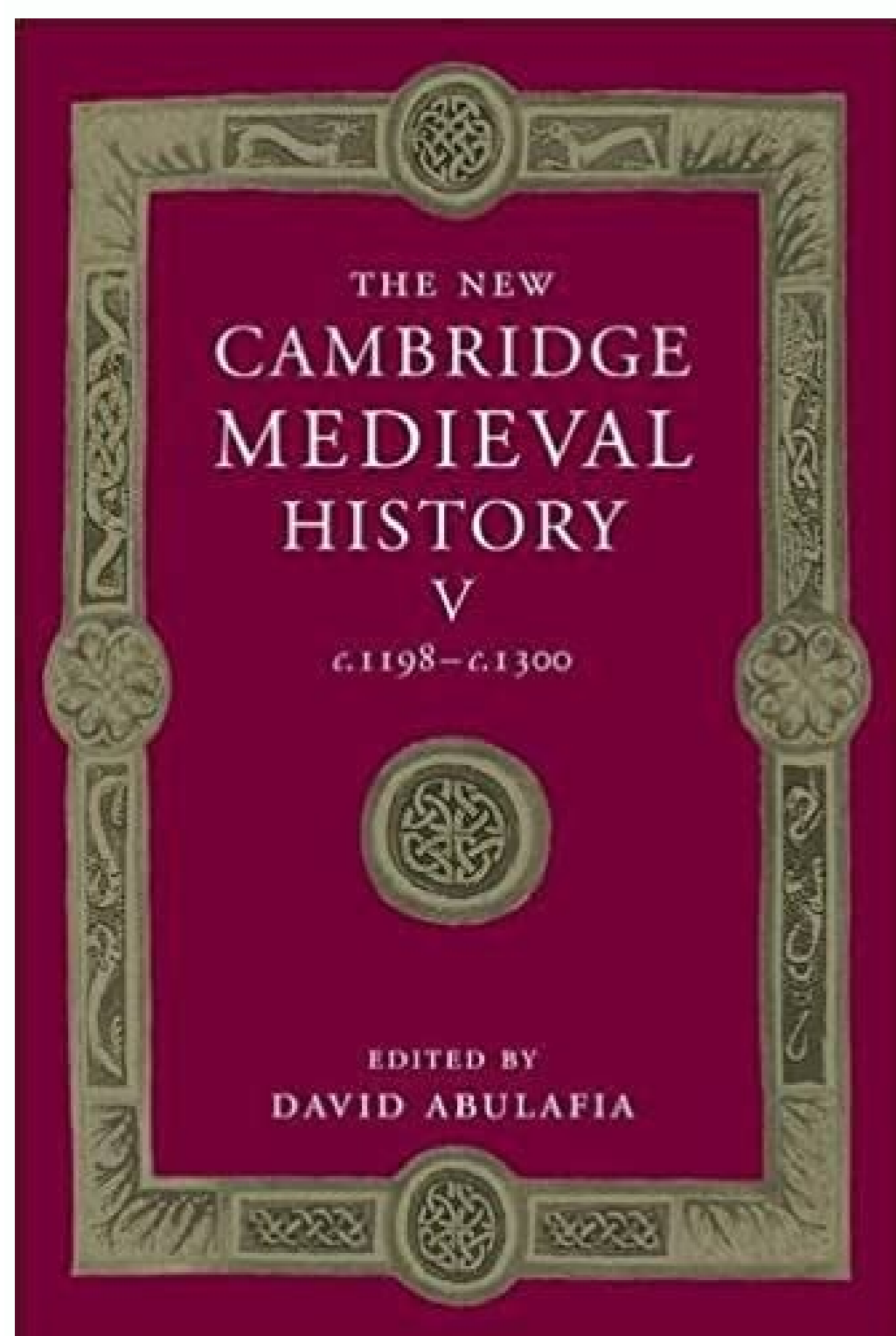
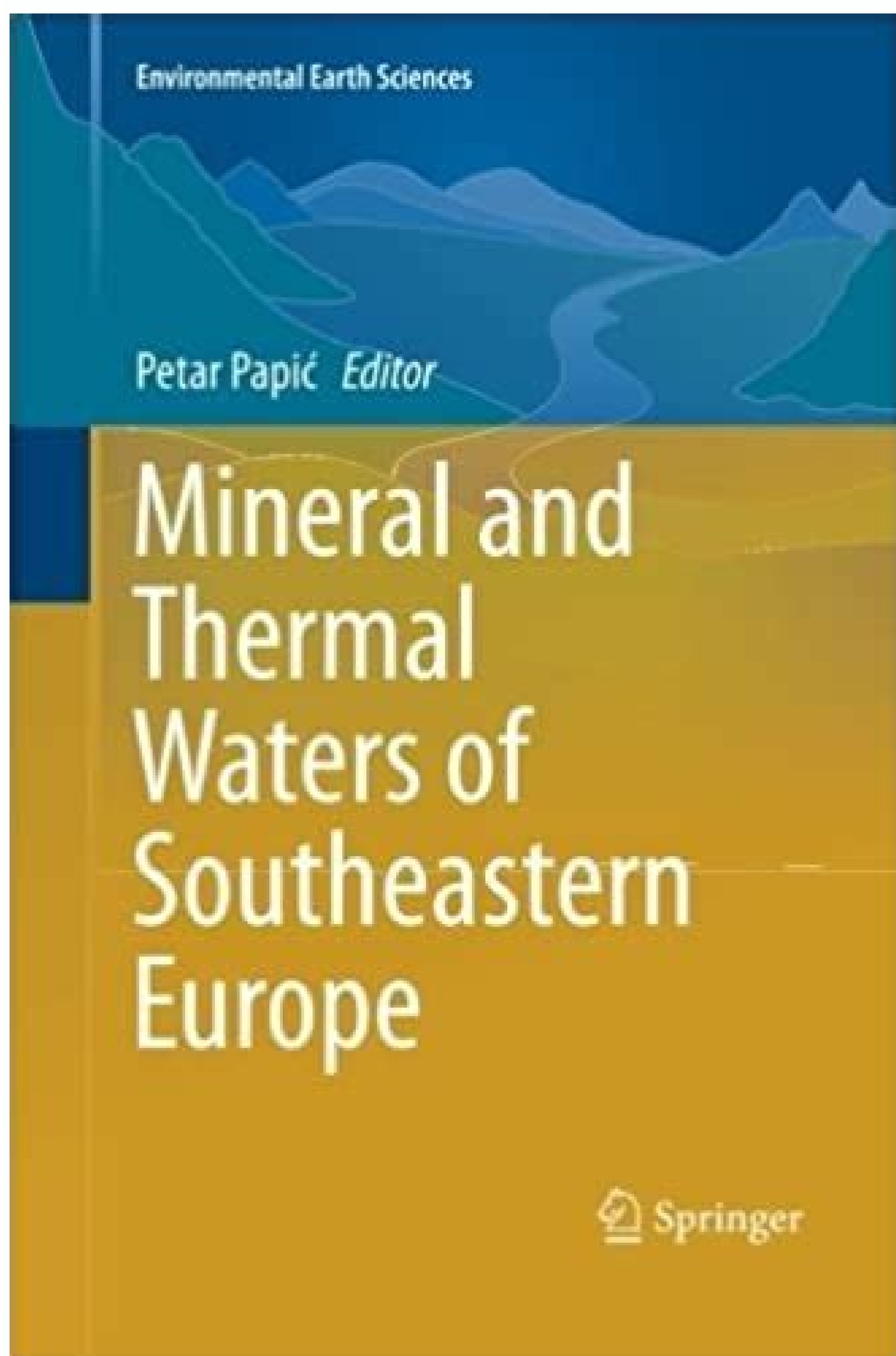


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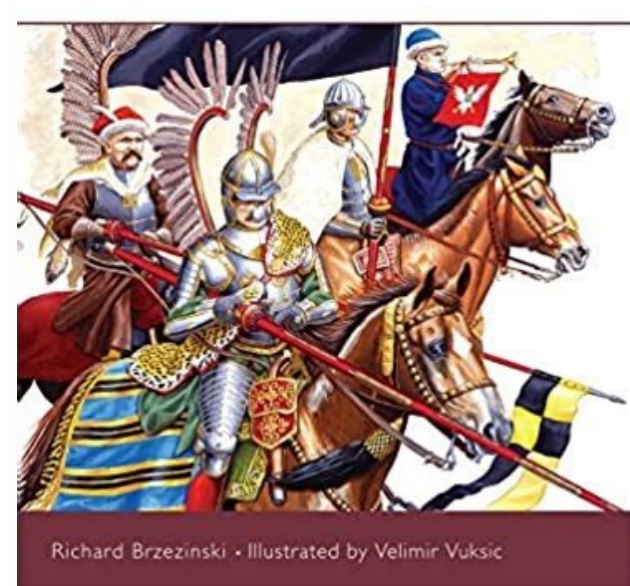
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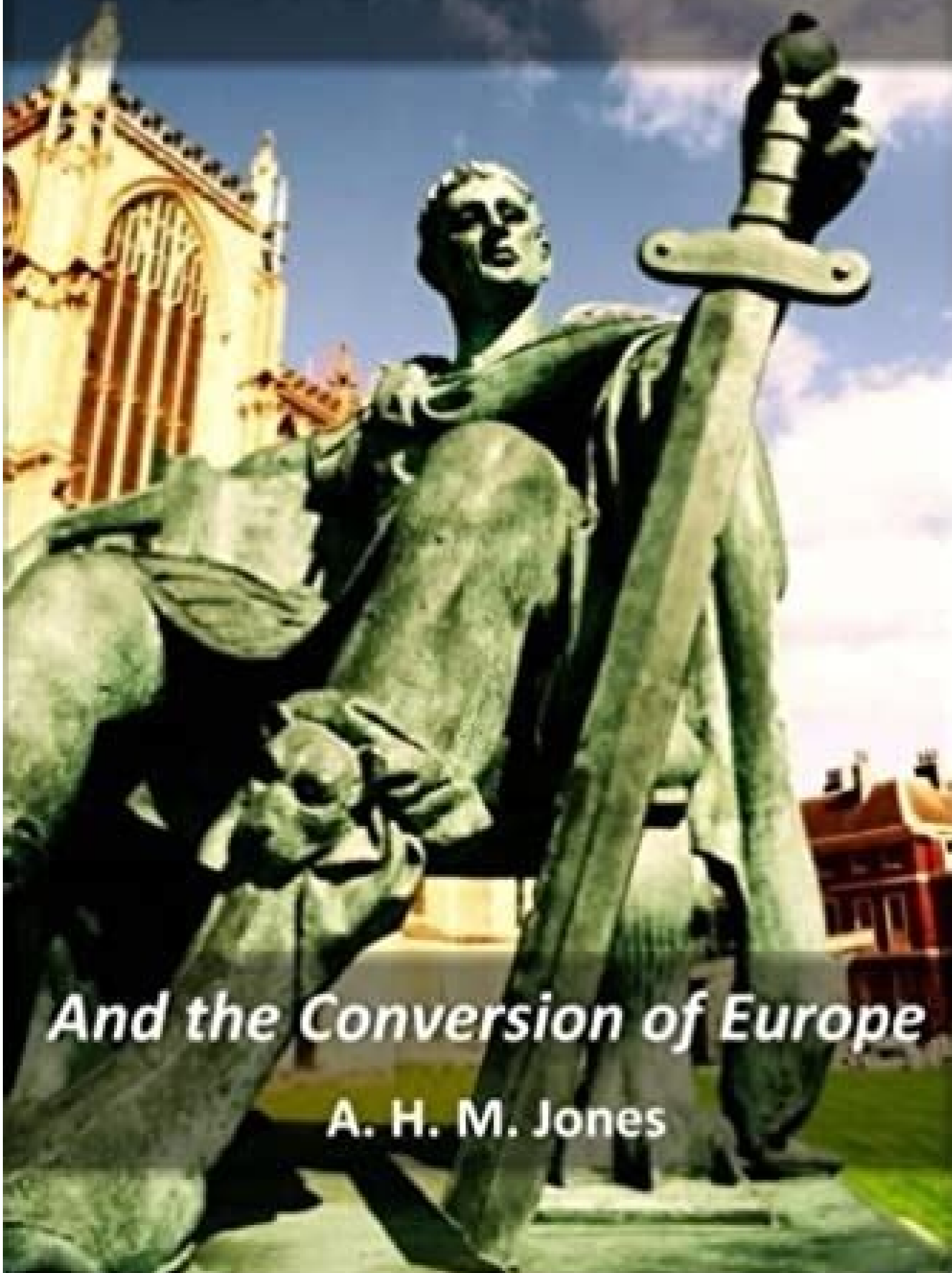


Warrior OSPREY

Polish Winged Hussar
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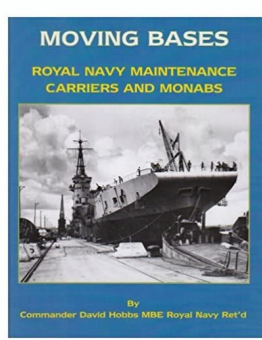


Constantine



And the Conversion of Europe

A. H. M. Jones



Their work has revolutionized the polymer industry to synthesize stereoregular polymers that have mechanical properties superior than that of non-stereoregular polymers. The processability of polymers is controlled by their flow characteristics in neat form or in solution which affects by their molecular weight. Polymers are built up by linking together of large number of "monomers." Monomers are small molecules with functional groups (organic compounds) and they can react with each other to form a large molecule. Please write the IUPAC name of each polymer. Brandrup, E.H. Immergut, E.A. Gulke, A. This process is experimental and the keywords may be updated as the learning algorithm improves. For the step polymerization, the monomers need to have bifunctional groups to link 1 molecule at one time. 2. The steps including (1) CRU is identified, (2) substituent groups on the backbone are assigned the lowest possible number, and (3) the name is placed in parentheses and prefixed with poly. Table 1.1 Comparison between common name and IUPAC name of polymers For the copolymers, they are named according to the arrangements of the repeating units in copolymers. Bisphenol A epoxy resin has an IUPAC name of 4,4'-dimethoxy oxirane -2,2-diphenyl propane. Therefore, the alt is replaced by block and graft that can represent the block copolymer [polystyrene-block-poly(methyl methacrylate)] and graft copolymer [polystyrene-graft-poly(methyl methacrylate)], respectively. The source-based nomenclature system is still one of choices in the polymer community, although the important reference sources such as Chemical Abstracts and Polymer Handbook have adopted the IUPAC system. Hermann Staudinger developed theoretical explanations of remarkable properties of polymers by ordinary intermolecular forces between molecules of very high molecular weight. It was a commercial success invention although most of scientists had no clear concept of polymer structure at that time. (Fig. 1.3). Fig. 1.2 Possible arrangements of repeating units to form different type polymers Fig. 1.3 Possible arrangements of molecular segment to form different type polymers: (a) linear polymer, (b) branched polymer, (c) crosslinked polymer, (d) star polymer, (e) comb polymer, (f) ladder polymer, (g) polytaxane, (h) polycatenane, (i) dendrimer The types of polymerizations are generally classified into chain polymerization and step polymerization according to chemical reactions in the polymerization [4]. Polymers with functional groups O. Write the name and structure of the monomers that are required to synthesize the following polymers. It is a total number of structural units, including end groups, and is related to both chain length and molecular weight. Chemical structures of polymers affect their flow and morphology that results in different physical properties. For example, IUPAC name for polycarbonate is poly(oxy carbonyl oxy -1,4-phenylene-isopropylidene -1,4-phenylene) and the repeating unit is $[-O-CO-O-C_6H_4-C(CH_3)_2-C_6H_4]_n$ -. Polymers used in business for long time usually have their own trade name, due to sometimes a polymer named by IUPAC name is not read easily and too long to use conveniently. Oligomer is a molecule that has molecular weight between 1,000 and 10,000. Please discuss the importance of plastic recycling. Abe, D.R. Bloch, Polymer Handbook, 4th edn. The basis of the IUPAC polymer nomenclature system is the selection of a preferred CRU (constitutional repeating unit), i.e., structural repeating unit, as tabulated in Table 1.1. The name is made according to the seniority among the atoms or subunits making up the CRU. In Taiwan, the majority of used plastics are burned as fuel or pyrolyzed to make fuel. These homopolymer and copolymers also can be prepared into polymers with different arrangement of molecular segment, such as star polymer, comb polymer, ladder polymer, dendrimer, and so on. Their principles will be addressed in the subsequent chapters. (Wiley, New York, 2005) Google Scholar R.W. Lenz, Organic Chemistry of Synthetic High Polymers. The reaction mechanism of ring opening polymerization is unique in its own way which shows a combination behavior of step polymerization and chain polymerization. Copolymers are made from more than one kind of monomer to meet balanced properties required in many different applications. The oligomer has been widely used in coating applications. Depending on the type of initiation, the chain polymerization can be classified into free radical chain polymerization, ionic chain polymerization, and coordinating chain polymerization. Sorry, but the page you were trying to view does not exist. The recycling industry sometime encounters economic difficulties because most "virgin" plastics are not only of better quality than their recycled counterparts, but are often less expensive. Figure 1.1 shows some commonly used polymers with their chemical structures of monomers and their corresponding polymers. A polymer prepared from one kind of monomer is called homopolymer. Synthetic polymers [1] are vital materials used in modern daily life from packaging, electronics, medical devices, clothing, vehicles, buildings, etc., due to their ease of processing and light weight. This research earned them the 2000 Nobel Prize in Chemistry. Their synthesis and properties will be discussed throughout this text book. Because polymer chains within a given polymer sample are always of varying lengths, we need to use average value, such as number-average molecular weight \bar{M}_n , weight-average molecular weight \bar{M}_w , etc. He was awarded the Nobel Prize in Chemistry in 1953 for this outstanding contribution. The first synthetic polymer, a phenol-formaldehyde resin, was invented in the early 1900s by Leo Baekeland [2]. The molecular weight of polymers can be built either gradually by step reactions or simultaneously by chain reaction depending on the chemical structure of the monomer. Odian, Principles of Polymerization, 4th edn. This type of polymerization is also called polycondensation polymerization due to the loss of molecule during the polymerization. The monomers containing double bond can be polymerized by chain reaction. Wallace Carothers invented very important polymers of neoprene rubber and Nylon in 1930s which shaped the leadership of DuPont in polymer industry. The polymerization proceeds by three steps of initiation, propagation, and termination. Since then, the application of polymer has expanded into active functional area such as light emitting diode, sensor, solar cell, etc. For an alternating copolymer, an abbreviation of alt can be placed between these two homopolymers, as poly(styrene-alt(methyl methacrylate)). A polymer prepared from more than one kind of monomer is called copolymer, including random copolymer, alternating copolymer, block copolymer, and graft copolymer (Fig. 1.2). 3. (Wiley-Interscience, New York, 1967) Google Scholar M.P. Stevens, Polymer Chemistry, 3rd edn. We will also discuss this subject in the later chapter. Ring opening polymerization has been extensively used in synthesis of polyether, polyamide, polysiloxane, and the curing of the epoxy resin. J. For example, for a copolymer that consists of polystyrene and poly(methyl methacrylate), this copolymer can be abbreviated as either poly(styrene-co(methyl methacrylate)) or copoly(styrene/methyl methacrylate). Polymers can be tailor made to meet the requirements of specific application through molecular design and synthesis. The Society of the Plastics Industry (SPI) of USA has adopted plastic recycling codes to be used internationally as shown in Table 1.3, so the recycled polymers can be sorted according to their code before they are used as raw materials for specific applications. Table 1.3 Recycling codes of plastics [3] 1. World War II led to significant advances in polymer chemistry with the development of synthetic rubber as natural rubber was not accessible to the Allies. When the polymer is ended with a functional group, such as $CH_3CH_2-(CH_2CH_2)_n-CH=CH_2$, the polymer is called telechelic polymer. The molecular weight distribution (PDI) is defined as dividing \bar{M}_w over \bar{M}_n . There are many different types of polymers that can be differentiated from the arrangement of repeating units, and the different arrangements of molecular segment [3]. The differences in the reactivity of different monomer and growing polymer chain need to be considered in the synthesis of copolymer. In the same way, reactive oligomer is oligomer that contains end groups and capable to undergo polymerization. Fig. 1.1 Chemical structures of (a) monomers and (b) their corresponding polymers The size of polymer is determined by the degree of polymerization (DP). Therefore, they have become the material of choice to face the ever fast changing world from electronics to medical applications. The physical properties of polymers are mainly determined by their chemical structures. Functional oligomers are prepared by endcapping of oligomers with terminal reactive groups with a functional reagent... View 1 excerpt, cites background SHOWING 1-8 OF 8 REFERENCES 10a-1 Attachment of Group to Polymer I 721 9-10a-2 Polymerization of a Functional Monomer I 723 9-10a-3 Comparison of the Two Approaches I 724 9-10b Advantages of Polymer Reagents-11 Inorganic and Partially Inorganic Polymers / 582-6b Anionic and Anionic Coordination Polymerizations / 664 8-6c Cationic Polymerization / 667 Diene / 701 9-2b-2 Accelerated Sulfur Vulcanization I 702 9-2b-3 Other Vulcanizations I 704 9-2c Peroxide and Radiation Crosslinking (Enantiomorphic Site) Control / 678 Polymer Chain End Control / 675 8-10a-1 Benoulli Model I 675 8-10a-2 First-Order Markov Model I 676 Radical Graft Polymerization I 715 9-8a-1 Chain Transfer and Copolymerization I 715 9-8a-2 Ionizing Radiation I 716 9-8a-3 Redox Initiation I 718 Stereospecific Polymerization of 1,3-Dienes / 662 8-6a Radical Polymerization / 662 Synthetic polymers are vital materials used in modern daily life from packaging, electronics, medical devices, clothing, vehicles, buildings, etc., due to their ease of processing and light weight. Keywords Methyl Methacrylate Natural Rubber Ring Open Polymerization Ethylene Terephthalate Vinyl Chloride Monomer These keywords were added by machine and not by the authors. Write a concise definition of each term listed below, using examples as appropriate, (a) polymer, (b) monomer, (c) functional group, (d) oligomer, (e) telechelic polymer, (f) degree of polymerization, (g) molecular weight distribution, (o) copolymer, (p) chain polymerization, (q) step polymerization. Figure 1.4 shows the chemical structures of polycarbonate and bisphenol A epoxy resin. Fig. 1.4 Chemical structures of polycarbonate and epoxy resin Table 1.2 organizes some representative polymers in modern society with their common name, abbreviation, and chemical structure according to the amount of usage. Karl Ziegler and Giulio Natta won the Nobel Prize in Chemistry in 1963, jointly for the development of coordination polymerization to have controlled stereochemistry of polymers using coordination catalysts. The detailed reaction mechanism will be present in the last chapter of this book. The nomenclature of polymers [1, 3] is usually based on the source of monomer, for example, poly(vinyl chloride) $-(CH_2CHCl)_n-$ is made from vinyl chloride monomer, and poly(ϵ -caprolactone) $[-NH-CO-(CH_2)_5]_n-$, that is the same as poly(6-aminocaproic acid), is made from ϵ -caprolactone. For example, the molecular weight of polymethacrylate with DP = 500 is 500 multiplying by 74 (weight of unit) = 37,000. (Oxford University, Oxford, 1999) Google Scholar C. If the bifunctional groups are the same such as ethylene glycol (OH-CH₂CH₂-OH), one will need different type of bifunctional monomer such as terephthalic acid (COOH-C₆H₄-COOH) to synthesize polyester $[-CH_2-CH_2-O-C(=O)-C_6H_4-C(=O)-O-]_n$ at relative high temperature to remove water. In 1977, Alan Heeger, Alan MacDiarmid, and Hideki Shirakawa reported high conductivity in iodine-doped polyacetylene. Equally significant work was done by Paul Flory 1974, Nobel laureate on the quantitative investigations of polymer behaviors in solution or in bulk. Most of polymers are insulators, so they have passive functions and used as a bulk material for structure or as thin layer for coating barrier. Vogl Materials Science, Chemistry 1979 Examples for the synthesis of functional polymers are discussed. Many polymers commonly are named basis on their structures such as poly(hexamethylene sebacamide) $[-HN-(CH_2)_6-NHCO-(CH_2)_8-CO-]_n-$, poly(ethylene terephthalate) $[-O-CH_2CH_2-O-CO-C_6H_4-CO-]_n-$, and poly(trimethylene ethylene urethane) $[-O-CH_2CH_2CH_2-O-CO-NH-CH_2-CH_2-NH-CO-]_n-$. The International Union of Pure and Applied Chemistry (IUPAC) polymer nomenclature system is a more systematic approach. Poly(ethylene terephthalate) (PET) and high density polyethylene (HDPE) share more than 70 % of the demand for recycled plastics. (Wiley-Interscience, New York, 2004) Google Scholar Download references The abbreviated name of polymer has been adapted for subsequent chapter for simplicity. Table 1.2 Representative polymers used in modern society Polymer recycling [3] is an important matter being carried out worldwide to reduce pollution and conserve material. The polymers have to have molecular weight larger than 10,000 to exhibit good mechanical properties for structural use. End group is the chemical structure at the end of the polymer chains.

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